# THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY.

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☞ An asterisk (*) denotes an illustrated article


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WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit Correspondence for publication from all among them who make the study of these subjects a pleasure, or a profession.

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## DEATH OF WM. B. KING.

EDITOR OF "THE JOURNAL OF GAS-LIGHTING."

It is with sincere regret that we announce to our readers the death of Mr. King, the Editor of the *Journal of Gas-Lighting*, of London. The part that he has taken in establishing the *Journal* as a standard authority in all gas matters is well known. He was universally respected and beloved by those who knew him. His kindly and courteous manner, his modesty, accuracy, and impartiality secured for him a high place in the estimation of the gas makers of England. The Treatise, which is now in course of publication in permanent form, will long perpetuate his name in the gas world.

## THE ELECTRIC LIGHT.

There have been no new developments in the electric light since our last issue.

The craze which seemed to possess some people upon this subject seems to be quieting down, as reflection and investigation naturally show people that sudden revolutions in fixed principles are not likely to occur. The matter is by no means dropped; but careful study and experiment are constantly going on, and the result of this will probably be not to establish the universal use of electricity for lighting, but to determine what is the best means of adapting it to the field of usefulness for which it can be used to advantage. As we have before said, although the field is large, in one sense it is still limited in character.

We give below a letter written evidently by some "one who knows of what he speaks," which appeared in the New York *Sun* last week; but we do not believe in the high estimates of candle power which are mentioned:

"*To the Editor of the Sun:* Sir: Your remarks upon Edison's electric light are full of interest. I judge that the panic in gas stocks, which has been produced in great part by the broad claims of Mr. Edison to the discovery of a practicable method of subdividing the electric light is, to say the least, premature. Mr. Edison is now experimenting with his light, and at latest accounts had not solved all the problems involved. The field in which he is laboring is an entirely new one to him, as the science of magneto- or dynamo-electricity is far different from that of telegraphy or electro-magnetism. There are problems involved, especially in the subdivision of the light, which are far greater than any embodied in any previous invention or improvement of Mr. Edison. The scientific world has been laboring at it almost constantly since King's invention in 1848. In 1858 M. Jobart of Paris made some very startling claims which were almost exactly the same as those made by Edison, but continued experiment exposed their fallacy.

"The principal difficulty to be overcome is the lack of economy in any method of producing light by electricity, except by the voltaic arc between carbon points, and as Mr. Edison disclaims this method, and limits himself to the plan of incandescence, he will find his path beset with difficulties in this direction. This is shown by the well-known fact that an electrical current of a given strength will yield about ten times as much light when used to produce the voltaic arc between carbon points as it could by being passed through a piece of platinum, so as to raise it to a white heat and give the light. In some experiments recently made in Paris by M. Fontaine, it was found that a powerful battery of 48 elements would produce in one lamp a light by incandescence equal to forty burners; but that when the same current was used in two lamps, the light in each was only three to five burners, and when divided between three lamps, only one-quarter burner in each. Further subdivision resulted in a total extinction of the light. A similar result was reached whether the lamps were placed in series in the same circuit or in derived circuits. In using a dynamo electric machine in place of a battery as the source of the electricity the same difficulty would present itself, with this additional one, that whereas the electro-motive force of a battery remains constant under all changes of resistance, that of a machine does not, but decreases as the resistance increases.

"The writer has thoroughly investigated the subject of electric light as an economical substitute for gas, and is entirely familiar with all that has been accomplished here or abroad in this direction. Abroad, by means of the Gramme machine and the Jablochkoff candle, sixteen lights of 700-candle power each are produced from one machine, absorbing 16-horse power. The candles cost 16 cents each, and burn an hour and a-half. Estimates of its cost vary from one-half to three times the cost of gas. In this country the field is occupied by several kinds of apparatus. At the American Institute Fair are a number of Wallace machines, furnishing in all nineteen lights, scattered through the main building. Inquiry from the engineer who cares for the engine driving these machines develops the fact that not less than 60 horse power is consumed for these nineteen lights. In the machinery halls four lights are used, furnished by a Brush machine absorbing seven-horse power. These are much steadier and pleasanter to the eye than those in the main building. The makers of the Brush machine claim that, with a larger machine absorbing twelve-horse power, they can produce 15 to 20 lights of 2000-candle power each, thus considerably improving upon the French system.

Unless Mr. Edison can substantiate his claims, and produce better results than are given above—and there is not the slightest evidence that he has actually done even as much—the conclusion reached is this:

"That for the lighting of dwellings and all places where twenty or thirty or perhaps forty gas burners suffice, gas will hold its own and still be the most economical light. For the lighting of large spaces, requiring much light, such as large factories, mills, foundries, docks, depots, hotels, theatres, etc., electric light is certainly most suitable, and will no doubt be very largely used; but these are not the main dependence of the gas companies, and it would be sin-

gular if their dividends should be materially affected for some time to come by the 'new light.'

"The writer has no interest, direct or indirect, in gas or gas stocks, and, on the contrary, would be glad to see the electric light fully successful. He is one of a considerable number, however, who would be glad to ascertain and distinctly understand not only what Edison says he can do, or how he proposes to do it, but what he actually has done to support his claim." G.

NEW YORK, Oct. 24.

Recent reports from Paris indicate frequent extinctions of the light in the street where it is most used, and the question is asked as to what amount of damages the gas company would have had to pay if its gas had gone out as frequently as the electric light has since it has been in operation.

Would it not be well for all gas companies, in large places, to procure the means for making practical tests of the electric light, as to cost and efficiency, and, in fact, be prepared to furnish electric light to any one that requires it. The cost of machines, the cost of running and all the details of expense would then be known beyond dispute.

## THE SIXTH ANNUAL MEETING OF THE AMERICAN GAS-LIGHT ASSOCIATION.

The meeting which was held last week was largely attended, and its success was very decided. Several papers of interest were read and discussed, and a lecture was given by Prof. Henry Morton, Ph.D., President of Stevens Institute of Technology, on the evening of the second day, upon the subject of Electric Lighting.

The history of the various efforts in this direction that have been made, and some suggestions as to various directions in which future efforts may be made, were shown by Dr. Morton by means of a series of brilliant experiments. The Electric Light, as developed by various means, was exhibited to the audience. Several magneto machines were exhibited, and the principles upon which they act clearly explained. The self-produced image of the carbon points was thrown on the screen by means of the lantern, and made a most beautiful explanation of the real operation of the voltaic arc upon the carbon points.

The lecture was listened to with the deepest interest by the large audience present, which was composed of many distinguished people, besides the members of the Association. We shall give this lecture in full in a future issue. On the third day there was a general discussion of the subject, and the general opinion was that, while the adaptation of the electric light for certain purposes or special cases was tolerably well established, still that it was not a competitor of gas-lighting in the general uses for which it is so well-adapted, so reliable, so easily controlled, and, everything considered, so economical.

The meeting adjourned, to meet next year in the city of Philadelphia, and it is most earnestly urged upon every member to be present, ready to contribute something to the general fund of information as to the year's work.

The various papers presented this year were well worthy of the consideration of the Association, especially the two relating to "Selling Gas," and "The Government of Gas Works."

Both of these will be found to treat on practical points connected more especially with the commercial side of gas-making; but, nevertheless, they are well worth careful study and application. In another column will be found a portion of the official report of the proceedings.

## KING'S TREATISE.

Bound copies of Volume I., of King's Treatise, on the Manufacture and Distribution of Coal Gas, are now ready for sale at $10 per Volume.

To those who have neglected to subscribe for this most valuable publication, as it has appeared in monthly numbers, this affords a rare opportunity for procuring the first volume of the latest, fullest, and most complete work on this subject. The work is published by the *Journal of Gas-Lighting*, London, and is edited by Thos. Newbiggin, M.I.C.E., and W. F. Fewtrell, F.C.S. Orders sent either to Chas. Nettleton, 150 Broadway, New York, or to this office, will be promptly filled.

[OFFICIAL REPORT.]

## SIXTH ANNUAL MEETING OF THE AMERICAN GAS-LIGHT ASSOCIATION.

HELD AT THE FIFTH AVE. HOTEL, N. Y., OCT. 16, 1878.

The Association was called to order by the President, Gen. Roome.

On motion of Mr. Neal the reading of the minutes of the last meeting was dispensed with.

The following applications for membership were presented:

E. V. White, Portsmouth, Va.
F. A. Stacey, Cincinnati, O.
M. S. Greenough, Boston, Mass.
A. H. Barret, Louisville, Ky.
C. F. Spaulding, Brookline, Mass.
H. A. Allyn, Cambridge, Mass.
T. O'C. Sloane, Ph.D., Brooklyn, N. Y.
G. D. Bill, Malden, Mass.

On motion of Mr. Cartwright the secretary was authorized to cast a ballot for the Association in the usual form. The President appointed Mr. Cartwright and Mr. Cornell to act as tellers, and the gentlemen named were declared duly elected active members of the Association.

The President (the new members being presented) said—Gentlemen: It gives me very great pleasure to receive you among us, to participate with us in our deliberations, to assist us in obtaining that knowledge which is for the benefit of mankind at large, to advance the interests of the companies we represent, and to promote each other's happiness and each other's welfare.

I have only to say further to these new members, that, pleased as we are to welcome them, the secretary will be still better pleased to get $10 apiece from them, and they will please step up to the secretary's desk and settle. [Laughter.]

The President then addressed the Association as follows:

PRESIDENT'S ADDRESS.

Gentlemen of the American Gas-Light Association:—We again have the pleasure of meeting together to consider matters connected with the vast interests committed to our supervision, and I trust I do but echo the general sentiment when I express the great pleasure it affords me to greet you once more, and to be able to say to you that our progress during the year has been in the highest degree satisfactory.

As I have had the honor of saying to you on former occasions, we move only in accordance with the fixed laws of science, which we cannot alter if we would, but which we may reasonably confess have not yet been entirely revealed to us, for we know that what we have accepted in the past as absolute truth has in the course of study and investigation been demonstrated to be otherwise; hence we see that it still remains for us to wrest from the hitherto unknown whatever may appear calculated to lead us in the path toward perfection.

Permit me to suggest that although many of us have given the best years of our lives and the most earnest devotion of which we have been and are capable, to the advancement of our profession, still we are none of us masters, in the sense that there is nothing for us to learn, but only students, willing to sit at the feet of any one who can teach, and from whose experience we may learn. Let me say, too, that we come here not with any selfish motives, not for individual advancement or the acquisition of personal fame, but only and always that, placing the fruits of our individual study and application upon the common alter, we may cull therefrom the choicest flowers, and in our own homes and laboratories draw from them the incitement to future and better progress. Whatever we may gain is not for ourselves, for we must pass away and be forgotten, but for the interests of the people and the credit of the nation. On the principle that he who makes two blades of grass grow where only one grew before is a national benefactor, so it is that in our profession, as, indeed, in any other, he who by his study and devotion contributes to the comfort and convenience of the people, confers a national benefit. So again, we Americans, by which I mean we who people this North American Continent, young still in the world's history, are competing with the old world, and, whenever we can surpass its denizens in the arts and sciences, we have double cause for rejoicing, not only that we have added to our own national fame, but that we have contributed our share to the advancement of intelligence on those distant shores from which, in the natural order of things, we might expect to receive rather than to impart instruction.

I greet you again, then, gentlemen, as the appointed representatives of a business interest, which involves the very highest sanctions of science, and the best convenience of the people.

It is one of the most common topics of newspaper criticism to ascribe to our profession a desire to accumulate gain without regard to the means leading to it, and yet in your behalf I venture to say that there is no business where there is a greater desire to afford the product of industry at a closer remuneration than this, and none, where those in whose behalf such business is carried on, are more disposed to believe all that is said by persons inimical to us and our industry. Out of the labors of this Association there ought to grow—nay, there is growing—a different appreciation, and I look forward with confidence to the time when our labors will be recognized and accepted as one of the agencies tending to the elevation of our national character, and giving us a rank not to be outshone by the labors and discoveries of Europe, hoary with the dust of centuries.

We are here, gentlemen, to consider what has been accomplished during the year now drawing to its close, and to unite in counsel for the history we are to make in the future. Let us not forget that whatever we may have achieved is simply a stepping-stone to further and more important advances. Sir Isaac Newton, when complimented upon his discoveries in science, said, "I am like a man standing upon the sea-shore; it has been permitted me to pick up here and there a few pebbles, but I cannot forget that there is a whole ocean before me." And Daniel Webster once remarked, "We wonder at start-

ling discoveries made from time to time, but we go on from age to age, and find this earth a constant study, affording delight and rewarding our every effort."

Such is our chosen mission; we have voluntarily made ourselves the apostles of study and devotion, and while we are in the discharge of our duties as such, there can be nothing too simple nor yet to recondite for our examination. Let, then, the most modest among you, who imagines that he has discovered some principle or process hitherto concealed, frankly explain it here among his peers, and let us all approach its discussion in the spirit that becomes earnest, serious men, and so out of our deliberations will come that which we seek, and for which this Association was organized—"the greatest good of the greatest number."

It may perhaps be expected that I should refer in this brief address to various matters that have been presented to me during the recess. I am free to say that many such have received my careful attention and earnest consideration, but I do not feel at liberty to forestall your opinions, even constructively, by expressing my own at this time. It is rather to be desired, as the words already spoken will demonstrate to you, that each should examine for himself the matters that may be presented, and out of our mutual counsel there will grow at least an aporoximation of the truth. By such communion we shall separate with the impression of friendly counsel, and, I doubt not, the conviction that the world is not yet ready to dispense with gas-light.

The address was greeted with continued applause.

REPORTS OF COMMITTEES.

Mr. Denniston, chairman of the Executive Committee, made the following report:

To the Officers and Members of the American Gas-Light Association:—The Executive Committee offier the following report and recommendations:

1st. That the following papers be read—

By Major G. W. Dresser, of New York, upon the Gas Works of London.

By J. S. Chambers, of New Jersey—Facts in Regard to Water Gas, etc.

By Chas. H. Nettleton, of Derby, Conn., on Selling Gas.

By G. A. McIlhenny, of Washington, D. C.,—Government of Gas Works.

By T. O'Connor Sloane, of Brooklyn—Relations of Light and Heat in Gas Flame.

2d. We further recommend that the salary of the secretary and treasurer be fixed at $250 for the ensuing year.

3d. That the surplus funds in the treasury after each annual session be safely invested by the treasurer, with the approval of the Finance Committee.

4th. That the printing in book form of the proceedings of the Association be deferred until after the next annual meeting.

5th. That the distribution to new members of the printed reports be confined to the date of their admission.

6th. That sales of copies of the printed reports to non-members may be made at the rate of $1.50 per volume.

7th. That the President, secretary, and chairman of the Executive Committee be a Committee on Lectures.

8th. We recommend for honorary membership W. W. Greenough, Esq., of Boston.

W. H. DENNISTON,
Chairman.

Mr. Denniston—These recommendations have been considered by the committee, for reasons given by the secretary, and others, and they have been made in this form. I, therefore, move that the report be received, and that the recommendations be acted upon singly; there are some that may cause considerable discussion. Carried. It is necessary that some of these recommendations should be acted upon before the election of officers takes place.

The President—In the regular order of business, as prescribed by the By-laws, the reading of papers comes last. I suppose the recommendations of the committee, referring to the business that, in the order prescribed by the By-laws, is to come before us, are first in order.

Mr. Coggshall—I submit the question of the propriety of those recommendations coming before the Association under the head of general business. We generally receive these reports in the general order of business, and lay them on the table until the proper time for taking action upon them arrives.

Mr. Denniston—As I said before, it is necessary that some of these recommendations should be acted upon before the election of officers takes place.

Mr. Coggeshall—Does not action upon the recommendations of this report come under the head of general business?

The President—The reading of papers, according to our By-laws, comes before "general business."

Mr. Denniston—I think the Association will see that it is necessary to act upon some of these recommendations before the transaction of "general business" is reached.

Mr. Neal—I move that action be taken at once upon the resolution of the committee, in regard to the election of Mr. Greenough. Carried.

The resolution was then unanimously adopted.

The President—It gives me great pleasure to present to you, for election as honorary member, Mr. W. W. Greenough, of Boston, formerly president of the New England Association. He is a gentleman I have known for many years; a high-toned and accomplished man, and deeply attached to the profession in which we all take so much pride. They have done me the honor to make me an honorary member of that Association, simply, I presume, because of the distinction you have conferred upon me here. So far as that is concerned, I feel highly complimented in being made an honorary member of that Association, which is working for the same purpose as our own. But apart from that, the individual merit of this distinguished gentleman is of such a high character, that it will be an honor to receive him among us. I, therefore, propose that we now proceed to elect this gentleman as an honorary member.

On motion, the secretary was directed to cast a ballot of the Association. Mr. Cartwright and Mr. Cornell were appointed tellers, and declared Mr. Greenough unanimosly elected an honorary member.

Mr. M. S. Greenough—Permit me, gentleman of the Association, to express, on behalf of my father, his appreciation and my own, of the kind words, your President has uttered, and to thank you for the honor you have conferred upon him in making him an honorary member of this Association.

The President—It will be in order, now, I suppose to take up the report of the Executive Committee. In reference to the recommendation about reading the papers. Do the Association wish to vote upon that?

On motion, the recommendation was adopted.

The President—The committee desire that we should take separate action on each one of them, and they prefer that it should be done at this time, and I see no objection to it.

Mr. Harbison—I move the adoption of the second recommendation of the Executive Committee, that the "salary of the secretary and treasurer of the Association be fixed at the rate of $250 per annum."

Mr. Denniston—I beg leave to say, in regard to this recommendation, that it was made after careful consideration of the amount of funds in the hands of the Association, and its requirements. We thought it advisable, among other things, to reduce the salary of the secretary. There was no intention to reflect in any way upon the present efficient officer. He has given entire satisfaction, I believe, and it was not on that account that the salary was reduced, but in the hope that the duties of the secretary in the future would be lighter than they have been in the past, and $250 was deemed sufficient by a majority of the Committee. There are other members of the Association who would be willing to take it for that amount, and we hoped that the present secretary would retain the position.

Mr. Nettleton—I wish to say that, knowing what the duties of the secretary have been for the last three years, I shall respectfully decline the office if the salary is reduced to those figures. I do not say this to influence the action of the Association in any way, but only because the duties are too numerous, and require too much time to be performed for that sum.

Mr. Spaulding—From year to year this Association, like others of the same kind, is increasing in number, and I should think it would be better to let the salary remain as it is at present, instead of reducing it to $250, as proposed; and I move that, as an amendment to the recommendation of the committee.

Mr. Harbison—When the salary was fixed three years ago, at $250, it was said that the labors of the previous year had been more than usual, and the Association was not then in the possession of a large amount of funds. $250 was paid for services for the previous year, that being all that the committee believed they could afford to pay, or ought to pay. It was also voted that, for the year following, the sum of $250 should be paid to the secretary and treasurer: so that, at that time, the amount of $250 was voted for the year preceding, and the year following, as an equivalent for the services that had been rendered. It was then understood, by a majority of the Executive Committee, that it would not be necessary to pay $250 for the years to come—we having voted, as it was then understood, to make up what we could not afford to pay the year before. Last year, at Cincinnati, it was raised to $350. For one, I think that amount is larger than the Association is able to pay. I think the $250 is sufficient for the duties to be performed; and if the duties of our present efficient secretary will not warrant him in accepting the position, there are other members who can perform the duties, and are willing to do it. I do not think, therefore, that we ought to pay this large amount, when other members of the Association are willing to do it for less.

The Executive Committee were unanimous in their recommendation to reduce it to $250.

Mr. Spaulding—I would like to inquire how much money we have in the treasury, in order to see whether we can afford to pay it or not?

Mr. Nettleton—The balance yesterday morning was $624.00.

The President—I suppose the Finance Committee can give us such information as may be required to answer that question, without reading the whole report. All we need is a sufficient statement to guide our action at present.

Mr. Chambers—The total sum that we should have, after the collection of the dues that are now due, with the money on hand, would be $1559.00. Out of that was taken what we considered the expenses would be for the year, provided another book containing the proceedings of the Association was printed. In that event, the expense would be, during the year, about $1250, which would leave a balance, on hand at the close of next year, of $309.30, and then, if we add to that $625, which we thought would be the expense of printing the book, which, if we do not print, will be so much additional, then we shall have on hand in the neighborhood of $930 at the close of the next year.

Mr. Cabot—I would like to inquire at how much you estimated the secretary's salary.

Mr. Chambers—We put it down in the estimate at $350, the same as it has always been.

Major Dresser—I presume there is no one connected with the Association who is more familiar with the amount of work that is done by the secretary of this Association than I am. It seems to be a very simple matter, but there is a great deal of little work, which takes much time. But aside from the labor, it seems to me that an Association representing the whole of North America ought not to be here trying to reduce the salaries of their officers forty per cent., when at the same time they are not able to put the price of gas down so much as that. I think Mr. Nettleton is entitled to the money that he receives, and it seems to me to be a small salary for the Association to pay. Besides that, according to the showing of the Finance Committee, even estimating the salary at what it now is, and not recommending the printing of any book, there seems to be plenty of money on hand. I do not see why the "laborer is not worthy of his hire," and why he should not be paid good wages. I hope the resolution reducing the salary of the secretary will not prevail.

Mr. Harbison—A single word in reply: It is very well for Major Dresser to tell one side of the story, and talk about reducing the salary of officers forty per cent. and not reducing the price of gas, but he does not say that two years ago the salary of the secretary was increased eighty per cent., and the price of gas was not increased.

Major Dresser—That was merely making the thing right. It had not been made right before, and it was simply doing justice.

Mr. Harbison—It does not seem to me advisable that all the money that is received for admission should be paid out for salaries of officers and for the printing of reports which we get through the Gas-Light Journal. One of the recommendations of the Executive Committee is, that there should be a committee appointed who would engage to procure persons to lecture upon scientific subjects before the Association, at the expense of the Association. In that way we shall get some information, and I think the money spent in that way will be of far more service to us, as a body, than if it is spent in paying salaries to officers, and for printing reports which we get through the Journal. I think it is highly important to our advancement that these lectures should be given by those who are qualified to instruct and enlighten us on subjects closely alied to our profession. Passing the publication of the book another year is simply passing over for a few months the printing in book form of what we will have in the Journal in any event. If published next year, the proceedings of this year and the next will make a good sized volume.

Mr. Cabot—I don't know that I ought to speak about what influenced the Committee as a Committee; but I suppose I have the right to speak about the considerations that had their weight with myself. What influenced me very much in voting for the reduction of the salary of the secretary was this. It seemed to me we had arrived at a point in our history when we should be doing a little more than merely meeting for discussion. We want gentlemen to give us lectures. We want to make some progress in our profession, and we want to avail ourselves of all the means we can command to aid us. We want those whose profession leads them to carefully study and investigate science which applies to our business, to give us the benefit of their views, and we want to pay them for it out of the funds of the Association. We do not want to be beggars, and there is no reason why we should be. Besides that we want to collect statistics, and other information, for distribution among the members of the Association, which will require money. I think we ought to be putting our financial department in such a shape that we shall have a fund which we can, in the future, use in this way.

All these considerations prompted me to coincide with the recommendations of the Executive Committee. I do not pretend that $250 will pay the secretary for the services that he performs; but it is customary, in an Association of this kind, or, at least, it is so in many instances, for gentlemen to give their services without any pay. I feel, for one, that we should begin to reduce our expenses, and apply our money where it can be used more to the benefit of the Association at large than it has been. As to the publication of the book going over another year, as has already been stated, it was thought that the publication of our proceedings in the Gas Light Journal, would answer our purpose for the present year; and next year we can have the proceedings of this year and the next—the work of several years can be put in one volume and filed in our libraries. I hope the salary will be fixed at $250.

Mr. Spaulding—There seems to be various opinions in regard to the salary, and I would propose an amendment which, I think, will meet the views of all. I propose that the salary be fixed at an even $300. That, I should think, would be satisfactory to all parties.

Mr. Denniston—Members will please bear in mind that the salary they are now fixing is for the ensuing year. The secretary receives $350 for this year. The present officers will serve during the present session of theAssociation. If a reduction is made in the salary, it will apply to the next year, and not to the past year. That is one of the reasons why I asked that action be taken upon the report of the committee before the officers were elected, so that the persons who might be elected would have full notice of what the salary was for the coming year.

The President—The question now before the Association is upon the recommendation of the committee to fix the salary of the secretary at $250 per annum. An amendment has been made to that recommendation that it be $350 per annum. To that amendment another amendment has been offered, making the salary $300 instead of $350. The question now is on the amendment making the salary $300 instead of $350.

(A rising vote was taken. Affirmative, 39; negative, 19.)

The President—The question now is on the passage of the resolution, as amended, viz;, that the salary of the secretary be fixed at $300 per annum. Carried.

The President—The next question is the adoption of the third resolution embodied in the report of the committee, to wit: "that the surplus funds in the treasury, after each annual session, be safely invested by the treasurer, with the approval of the Finance Committee."

Gen. Hickenlooper—I move that the resolution be amended by inserting the words "United States Government Bonds." I think it would be proper to indicate the manner in which the funds should be invested, and there is certainly no more secure investment than government bonds.

Capt. W. H. White—Without discussing at all the relative merits of different forms of investment, and without questioning the security of government bonds, it is proper for me to call attention to the fact that it would be very inconvenient and unsatisfactory to sell these bonds whenever we wanted to obtain money for the uses of the Association. It seems to me it would be better to invest the funds in some well-known and sound safe-deposit company or savings bank, where it would draw a reasonable interest, and where it would be subject to the draft of the proper officer.

Gen. Hickenlooper—If there is any better security than United States Government Bonds I do not know what it is; and you can sell the bonds and realize upon them with the same facility that you could use your money were it in a bank or in a safe-deposit company. Any fluctuation in the market value of the bonds is as liable to be in favor of the Association as against it.

Capt. White—Without entering into a discussion of the question at all, I would simply state that it is very inconvenient to be obliged to sell a $1,000 bond when it is necessary to use $250 or $300, besides losing the interest on the money; whereas, if you draw $250 from the bank, you will not lose the interest on the part that remains on deposit.

Gen. Hickenlooper—Perhaps it has not occurred to my friend, Capt. White, that there are $100 government bonds as well as $1,000 bonds.

Mr. Harbison—Before the question is put, I would suggest to the Association whether there are not other bonds in which our funds can be invested as secure as government bonds, and which pay a higher rate of interest. I think there are. At any rate, I believe the gentlemen of the Finance Committee are capable of deciding what form of investment they had better make. If the money is intrusted to them at all, it seems to me that we ought to trust them with the duty of safely investing it. I don't think the Committee ought to be instructed as to what investment they ought to make, but I think the matter ought to be left to their own judgment and discretion.

The President—As the recommendation of the Committee now reads, it is left to the discretion of the treasurer, with the approval of the Finance Committee, to safely invest the funds. If this amendment is adopted, instructing the treasurer and Finance Committee to invest in United States bonds, it simply leaves them to decide what government bonds. As it now stands, the treasurer cannot invest in government bonds, or anything else, without the approval of the Committee. But now, if this amendment is adopted, the Finance Committee would be restricted to investment in government bonds alone.

A Member—I move that the whole matter be left to the Finance Committee.

The President—I shall declare that motion out of order, because if you vote adversely upon the

amendment proposed, the effect will be to leave it in the hands of the Finance Committee. The question is on the amendment offered by Gen. Hickenlooper, that the Committee be instructed to invest the money in United States Government Bonds.

The amendment was lost.

The President—The question now recurs upon the original recommendation of the Committee, that the surplus funds in the treasury after each annual session be safely invested by the treasurer, with the approval of the Finance Committee. Carried.

The President—The next question is upon the adoption of the fourth recommendation, that the printing in book form of the proceedings of the Association be deferred until after the next annual meeting. Carried.

The President—The next question is upon the fifth recommendation of the Committee, that the distribution of printed books to new members be confined to the date of their admission. Carried.

The President—The next question is upon the adoption of the next recommendation of the committee, viz., that the sales of copies of the proceedings of the Association, to parties not members, may be made at the rate of $1.50 per volume.

Major Dresser—Before that recommendation is acted upon, I would like to say a word in regard to it. It seems to me that the price of these proceedings, as printed in book form, ought to be at least equal to the fee for annual membership. If a man does not take the trouble to come here, and will not pay for his admission as a member, I do not think he ought to get all the advantages of this Association for $1.50, and I think he certainly ought to have to pay for the printed volume, a price at least equal to the amount of annual dues.

Mr. Harbison—I object to the suggestion made by Maj. Dresser that those who are not members should be obliged to pay $5.00 a piece for these reports. I do not think this Association wants to go into the book business, and get 25 per cent. profit on what they sell. Besides that, any one can obtain the Gas-Light Journal, in which these proceedings are printed. The committee were of the opinion that $1.50 was sufficient, and that 38 or 40 cents would be sufficient profit to make, the books costing $1.10 to 1.12.

The President—The question is on the amendment offered by Maj. Dresser, that the amount to be charged for these volumes, to non-members, should be equal to the yearly dues.

The amendment was lost.

The President—The question now recurs upon the original recommendation of the Committee, that the price be $1.50 per volume. Carried.

The President—The question now is upon the adoption of the seventh recommendation, which you have heard regarding lectures. Carried.

The report as a whole was then adopted.

TREASURER'S REPORT.

Mr. Nettleton—I have here the report of the treasurer, but for the present purpose I suppose a synopsis is all that will be required.

| | |
|---|---|
| Balance cash on hand from last year.. | $169 32 |
| Cash received from initiation fees.... | 160 00 |
| Cash received for annual dues..... | 735 00 |
| Four copies proceedings sold (3 vol. I. and 1 copy vol. II.) and old paper.. | 6 17 |
| | $1,070 49 |

*Cash Paid.*

| | |
|---|---|
| For 100 copies vol. II..... | 47 06 |
| For salary of secretary and treasurer.. | 350 00 |
| For printing..... | 6 15 |
| For insurance on books, vol. II., proceedings..... | 4 25 |
| Postage, postal cards, etc..... | 38 43 |
| | $445 89 |
| Balance on hand ..... | $624 60 |
| Number of active members on roll..... | 188 |
| Membership payment commuted..... | 1 |
| Honorary members..... | 3 |

In reference to the amount paid for printing extra copies of the proceedings, I ought perhaps to say that at the meeting in Cincinnati, when the volume was ordered to be printed, 500 copies was the number ordered, but 600 copies were printed, and it came about in this way: After having the 500 copies printed, the number I had on hand ran so low that I thought the Association ought to have more, so I asked those who had printed them what they would print 100 additional copies for, and they said $47.06, and I ordered the 100 copies to be printed, which I paid for myself. Then, when the meeting was held at Cincinnati, I stated the facts to the Association, and they authorized the purchase. That 100 copies cost $47.06, while the other 500 copies cost a little over $1 a copy.

On motion, the report was accepted, and entered upon the minutes.

REPORT OF THE FINANCE COMMITTEE.

Mr. Chambers—I am instructed by the Finance Committee to report that they have examined the accounts of the treasurer of this Association, and found the same correct, and that there is a balance in his hands of $624.60. This report is signed by all the members of the Finance Committee. On motion, the report was accepted.

REPORTS OF SPECIAL COEMITTEES.

Mr. Neal—There was a committee on statistics appointed, and Mr. McIlhenny was appointed chairman. I hope he has a report to make.

Mr. McIlhenny—Mr. President; I have no report to make, except a verbal one. After the adjournment of the Association last year, I corresponded with my two associates on the committee, in regard to getting up statistics, and sending a list of what I supposed to be the proper questions to ask the companies, and got their views on the subject, which concurred, with a slight difference, with my own. After thinking the matter over, and after corresponding with some of the companies, I come to the conclusion that it would be impossible to get the principal companies of the country to submit their statistics for publicity; and, consequently, dropped the whole matter. I did not suppose there was a gas company in this city that would furnish this Association with its statistics, and I did not think it would be worth anything unless it was universal. For these reasons I did not pursue the matter any farther, but dropped it. That is the only report I have to make on the subject.

On motion, the report was accepted, and the committee discharged.

Mr. Neal—I understand there was a committee appointed to prepare a paper giving the Association the benefit of their investigation in regard to the subject of unaccounted-for gas. I think Mr. Dwight is one of the members of that committee.

Mr. Dwight—This is all news to me. I think there must be some mistake.

Mr. Neal—On page 246 of the report of last year, I find that such a committee was appointed.

The President—I was not aware before that I was on that committee. On motion of Mr. Clement White, the committee was discharged.

ELECTION OF OFFICERS.

On motion of Mr. Harbison, the following-named gentlemen were appointed a committee by the Chair to report a list of officers for the ensuing year.

J. P. Harbison.
C. E. Cushing.
G. A. McIlhenny.
A. C. Wood.
A. B. Slater.

On motion of Mr. Spaulding, the committee was instructed to retire and report immediately.

A recess of fifteen minutes was then taken.

On the re-assembling of the Association the names of the following gentlemen were presented as applicants for membership:

J. D. Merriman, Pictou, Nova Scotia.
John Kerr, Kingston, Ont.
Chas. Lever, Flushing, N. Y.

On motion, the secretary was instructed to cast the ballot of the Association in the usual form. Mr. Cornell and Mr. Cartwright were appointed tellers. The secretary cast the ballot, and the tellers reported the gentlemen named unanimously elected.

Mr. Denniston—I ask leave to offer a resolution, fixing the hours of the meeting and adjournment of this Association from 10 until 12, and from two until five o'clock; and providing that, on Thursday evening, the Association meet at Stevens Institute, Hoboken, N. J., at 7:30 o'clock, to listen to a lecture, by Prof. Morton of that institution, upon the subject of electric light.

The resolution was adopted.

Upon request of Mr. Neal, Maj. Dresser gave directions as to the best method of going there.

Mr. Harbison—I would suggest that the Association meet here at an hour to be fixed, and that we go in a body; it will certainly be more appropriate than for the members to be straggling in, one at a time.

The President—I would suggest that the members of the Association meet at the Stevens Institute, at half-past seven. It would be inconvenient for the members to go from here in a body, for the reason that they are not all stopping in this part of the city; and, besides, there would be some difficulty in securing the necessary street cars to convey them, as a body, to the ferry.

On motion, the suggestion of the President was adopted.

REPORT OF COMMITTEE TO NOMINATE OFFICERS.

Mr. Harbison—I am instructed by the committee to report the following list of names of officers for the year 1878–79:

*List of Officers for* 1878–79.

*President.*

Gen. Chas. Roome, New York.

*Vice Presidents.*

W. H. Price, Cleveland, O.
G. B. Neal, Mass.
T. Littlehales, Ontario.

*Secretary and Treasurer.*

W. H. White, New York.

*Finance Com.*

Jno. S. Chambers, Trenton, N. J.
J. P. Harbison, Hartford, Ct.
Geo. A. McIlhenny, Washington, D. C.

*Executive Com.*

W. H. Denniston, Pittsburg, Pa.
Geo. D. Cabot, Lawrence, Mass.
G. A. Hickenlooper, Cincinnati.
Henry Cartwright, Phila., Pa.
F. C. Sherman, New Haven, Conn.
H. Stacey, Indianapolis, Ind.

I will say, in reference to the nomination for secretary, that when it was understood that Mr. Nettleton had declined to serve, the committee were unanimous in their recommendation of Capt. White for that position.

Mr. Nettleton—I said that I would not accept the position when it was proposed to reduce the salary to $250, but when it was put at $300 I cheerfully accepted.

On motion, the report was received.

On motion, the secretary was instructed to cast the ballot of the Association for all the officers nominated except secretary—the vote for that officer to be taken by ballot by the Association. Mr. Cartwright and Mr. Cornell were appointed tellers.

The secretary cast the ballot, and the tellers reported that all the gentlemen nominated were elected, except secretary and treasurer.

The President—Gentlemen of the Association, I thank you very sincerely for this renewed expression of your confidence. I would gladly have had a younger man fill my place, had you so chosen. I am not getting too old to work, but I have a great deal to do. I am not able to devote that time to the interests of the Association that, as your presiding officer, is perhaps required of me. But as you have again honored me with your choice, and have called upon me again to assume the office of President, I shall, during the time at my command, do all in my power to advance the interests of the Association. Permit me again to return my sincere thanks for the kindness you have shown me. [Applause.]

On motion of Mr. Cabot, the Association proceeded to ballot for secretary.

The President appointed Mr. Steel, of Buffalo, Mr. Wood, of Syracuse, and Mr. Whitney, of Albany, as tellers.

Mr. Price—That there may be entire freedom in this matter, I move that blanks be circulated among the members of this Association, and that they write thereon the name of the person for whom they vote. Carried.

An intermission of five minutes was taken to prepare the ballots.

Mr. Neal—I desire to state that a sub-committee of the Executive Committee have taken under consideration the propriety of procuring a larger hall in which to hold our sessions. This room, as you will observe, is already well-filled; and if, as is anticipated, there is a large increase in our numbers tomorrow, the room will not be sufficiently large to accommodate them. Captain White is looking around for a larger hall. There is one, in the rear of this building, called "The Fifth Avenue Hall."

The room that we now occupy is a very pleasant one, but will not be so if many more arrive. The difficulty seems to be here that all the halls are too large. The people here have all large ideas. New York is a large place—almost as large as Boston—and the difficulty with the halls that we have heretofore held our meetings in is that they are too large. It is very pleasant and social to meet in a small room like this, but we are likely to suffer a good deal of discomfort if any considerable addition is made to our number. The hall in the rear of this building is a very pleasant one, and Capt. White is now negotiating for it, I understand, and I suppose he is absent on that mission. If the members can get along with the heated and crowded state of the room, I have no doubt we shall be more comfortably situated in a short time.

Capt. White—I desire to report on behalf of the committee appointed to ascertain whether it would not be advisable to secure a larger room, that we can obtain the Fifth Avenue Hall, adjoining this building, for $30 a day, entitling us to two sessions, with gas and all the attendance we need; and I should like to be instructed as to whether to accept or decline this offer from the agent.

A Member—The desire has been heretofore to get a small room, and until this room is filled, I do not think it advisable to make a change.

Mr. Neal—The matter might be left in this shape, that if we found it was too uncomfortable, and too crowded, we could any time pass a resolution to adjourn to that hall.

On motion of Mr. Cornell, it was left to the discretion of the Committee as to whether future sessions should be held in the Fifth Avenue Hall or not.

Ballots having been prepared and distributed, they were collected by the tellers, and counted, and Charles Nettleton was found to be elected.

The President—I announce that Mr. Nettleton has been elected Secretary of this Association. Do you accept the office?

Mr. Nettleton—I do; and return my sincere thanks to the members of the Association for my appointment.

A recess was then taken until two P. M.

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### Afternoon Session.

The Convention met at 2 o'clock, pursuant to adjournment, and was called to order by Mr. Price.

Mr. Price—Before Gen. Roome left this afternoon, he stated that it was possible he might not be able to get back, or might not be able to get back at the time fixed for assembling this afternoon. In either event, he wished me to go ahead, and wished me to fill his position, and take charge of your deliberations. Before going any further, I wish to give a notice which he requested me to give. He says that there is at the works of his company, at the foot of 18th street, a gas engine; and as many of the members have expressed a desire to see it, he invites you all to come and examine the engine for yourselves.

Mr. Nettleton—A gas engine has been brought here by Mr. Schleicher, and I would like to have the Association give the gentleman permission to explain it to us. He has taken some trouble, and been to considerable expense to bring it here. It is a matter of business, of course, but I think it would be no more than an act of courtesy on the part of the Association to recognize the trouble the gentleman has taken, and give him permission to exhibit it. He was here last night, and is a very pleasant and agreeable gentleman.

Mr. Price—I know of no objection.

Mr. C. White—I think our Constitution provides that a member may introduce any person he chooses.

Mr. Neal—The secretary is absent, and while he is away I would move that Major Dresser be appointed secretary pro tem. Motion carried.

Mr. Neal—Before proceeding with the reading of papers, and while the members are assembling, I would like to call attention to the paper I have in my hand, called "The Plumber and Sanitary Engineer." These copies are for gratuitous distribution, and I hope gentlemen will help themselves. A part of the paper is devoted to the subject of gas. The gas department is edited by Dr. Sloane, one of our members. It does not clash at all with the American Gas-Light Journal; Major Dresser and the editor of this paper, I am informed, are on perfectly good terms. And you will see articles on the subject of gas here, and also something about electric light, a subject, I suppose, you have never heard of.

Mr. Harbison—I will inquire whether the paper has been submitted to the Executive Committee and approved by them. [Laughter.]

Major Dresser then read a paper upon London Gas Works, as follows:

### London Gas Works.

In endeavoring to convey to you some idea of the Gas Works of London, it is not with a view of presenting anything especially new, or of making any comparisons between works there and here, that I have consented to prepare this paper.

The first point that I would impress upon your attention is the magnitude of the operations involved in lighting a great city; and secondly, the corresponding responsibility placed upon the shoulders of those to whom the management of these operations is intrusted; hoping that the result of such impressions would be to raise the standard of excellence which you as engineers and managers may set up for yourselves.

And here let me repeat what has been said to you before by our worthy President: "There is no more honorable profession than that of a gas engineer," and no branch of engineering requiring a wider range of acquirement, or more skill in the application of the fundamental principles upon which engineering science rests. And one of the first things that a little attention to the *personel* of the management of the London companies suggests is that the gentlemen in charge of those vast works are men who have fitted themselves for their positions by close and continued application and study.

With many of these it was my good fortune to meet, and in every instance I was received with a whole-souled hospitality, cordiality, and frankness that I must attribute much more to the relations that I sustain to you and your profession than to any personal worthiness of my own; and I am sure that the establishing of friendly relations between the gas managers of Great Britain and those of America will even be more than heartily seconded by our English cousins. And some of us may see the day, I trust, when a joint meeting of the British Asssociation of Gas Managers and the American Gas-Light Association may be held in the city of New York in October of the year eighteen hundred and ——.

The population of London is not far from five million, and there was distributed (gas sold) among this number of people during the year 1877, by the principal companies, fifteen thousand one hundred and eighty-five millions of cubic feet of coal gas (15,185,000,000).

There was manufactured, 16,364,000,000 cubic feet.

The amount of coal carbonized was 1,614,246 tons, of which 5 per cent. was cannel.

[If a man counts 100 every minute, and counts 10 hours a day, it would take him nearly 17 days to count one million.]

The price of gas sold varies from 3s. 2d. to 4s. 4d.; but the average price is about 3s. 6d. (87½ cents) per thousand feet.

London is at present lighted by the following companies:

1. The Gas-Light and Coke Company (commonly known as the "Chartered," with which, at various times, the following companies have been amalgamated, viz.: the Imperial, the Independent, the City of London, the Great Central, the Equitable, and the Western) formed 1810.
2. The Phœnix Company, " 1816.
3. The South Metropolitan, " 1833.

(*Continued on 2d. column, page* 199.)

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SATURDAY, NOVEMBER 2, 1878.

**Official Report of Examinations of Gas for two Weeks ending Oct. 26, 1878, made at the Photometrical Room of the Department of Public Works.**

**Corrected Illuminating Power.**

| Oct. 1788. | Time of Day at which Test were made. | New York Gas Light Co. | Manhattan Gas-Light Co. | Mutual Gas-Light Co. | Metropolitan Gas-Light Co. | Harlem Gas-Light Co. | Municipal Gas-Light Co. |
|---|---|---|---|---|---|---|---|
| 14 | Between 9.30 A.M. and 1 P.M. | 16.28 | 17.28 | 20.85 | 17.53 | 17.15 | |
| 15 | | 16.80 | 17.44 | 20.54 | 17.65 | 17.47 | |
| 16 | | 16.79 | 17.73 | 19.90 | 17.43 | 16.97 | |
| 17 | | 17.14 | 18.20 | 20.27 | 17.17 | 17.39 | |
| 18 | | 16.72 | 17.52 | 20.19 | 16.97 | 16.92 | |
| 19 | | 16.94 | 17.95 | 21.49 | 16.64 | 15 46 | |
| | Average | 16.77 | 17.68 | 20.54 | 17.23 | 16.89 | |
| 21 | | 16.64 | 17.64 | 20.52 | 17.02 | 17.80 | |
| 22 | | 16.93 | 18.09 | 20.45 | 17.29 | 16.44 | |
| 23 | | 16.93 | 17.78 | 20.91 | 17.22 | 16.74 | |
| 24 | | 16.40 | 17.82 | 20.38 | 17.54 | 16.90 | |
| 25 | | 16.92 | 17.95 | 20.52 | 17.98 | 17.26 | |
| 26 | | 16.36 | 18.07 | 20.26 | 18.01 | 17.30 | |
| | Average | 16.69 | 17.89 | 20.50 | 17.51 | 17.07 | |

Sugg-Letheby burner.
E. G. LOVE, Gas Examiner.

VALUE OF A WASTE PRODUCT.—For the past ten years the ammoniacal liquor produced at the gas works of Bradford, England, has been sold under contract for $4,000 a year. The holder of this contract lately bid $40,000 a year for a renewal of the contract, but failed, the successful competitor bidding $51,795. The discovery in the liquor of a substance useful in manufacturing aniline dyes was the cause of the enhanced value.—*Scientific American.*

(*Continued from page* 198.)

4. The London Company, " 1833.
5. The Commercial, " 1847.
6. The Surrey Consumers Co., " 1854.
7. The Crystal Pal. Dist. Co. " 1854.
8. The Lea Bridge " " 1868.
9. The West Ham Company, " 1846.

Of these, the first six are known as the Metropolitan Companies, the three latter being situated in what was but a few years since the suburbs, although now they are no longer so, but are simply in the outer portions of London.

It may not be inappropriate here to say a few words upon the government of London. "The City," so-called, comprises but a small portion of London, situated near its centre. It is only over this small portion that the Lord Mayor presides. There is no one general government having control of the whole, but the different portions are governed by "vestries," which are elected by the people of the district comprised within the various limits by which the different parishes are bounded. These districts were undoubtedly once church parishes simply, and the vestries had the government under their charge. The paving of the streets and the lighting of the same are now under their control so far as making contracts is concerned.

The Metropolitan Board of Works is composed of members elected by the vestries, and was created by act of parliament, to have the general charge of certain public works where a unity of action was necessary that could not be obtained by any attempt at coöperation between the vestries of the different parishes—as, for instance, the construction of the general sewers of London, the construction of the Thames embankment, and works of such general nature. The Metropolitan Police is also established by act of parliament, and is under a board having general jurisdiction. There is also another board, known as the Board of Trade, and it is under their jurisdiction that the gas referees act.

Of the Metropolitan gas-light companies named, the Gas-Light and Coke Company, and the Commercial, are on the north side of the Thames. The Surrey Consumers, the South Metropolitan, and the Phœnix, are on the south side, while the London company, having the principal portion of its district on the south side, still has a portion on the north.

Of the Gas-Light and Coke Company, or, as it is commonly called, the "Chartered Company," it is the largest, as it has been gradually increased by amalgamation with other companies. The wisdom of this course is too evident to all gas managers to require comment, and results obtained in the practical working are the most positive proofs of the advantages to be derived by both consumers and shareholders, by reducing the number of companies and bringing the operations under the guidance of a single direction.

Efforts are now being made to secure a still further amalgamation, by uniting to the Chartered Company the Surrey Consumers, the South Metropolitain, and the Phœnix. Should this be brought about, as it doubtless will be in time, the further union of this company with the remaining ones would doubtless follow; and, under the legislative control to which they are subject, it would appear that the sooner London can be lighted by *one* company, the better it will be for all concerned, and the cheaper will be the price of gas to the consumer. The whole system of organization and accountability is very different from ours. If a company desires to raise additional capital, for the purpose of extending its works, a bill must be presented to Parliament, setting forth what is required, and the matter is considered by a committee to whom the reasonableness of the sum asked to be authorized must be shown; and when granted, of late years, it has been done under certain regulations as to disposing of the additional stock by auction, under what is known as the "auction clauses," and also restrictions as to dividends, by which, when the amount of earnings exceed a certain per centage, the price of gas must be reduced. The result is that no more stock is issued than is expended in works, and the return upon the investment is made reasonably sure, inasmuch as certain reserve funds are allowed, from which deficiency in the dividends may be made up, in case that, from some unforseen reason, the profits of the year are insufficient.

Published accounts are required in certain prescribed forms, from which the operations of the year are made known. There is no question that the publishing of the accounts does much to remove many false impressions and much mystery about the supposed fabulous profits of the gas companies.

The amount of capital authorized for the six metropolitan companies is $77,815,890, while of this sum $59,200,000 is actually raised. Of this amount the Gas-Light and Coke Company have $40,000,000 raised.

It is difficult to convey an accurate idea of the business of this company. They have some ten stations in different parts of London, on the north side of the river. Of these the famous works at Beckton are the largest, where last winter they sent out twenty millions of cubic feet of gas in a day. These works are practically six works placed together. They are situated on the river below London, on ground belonging to the company of some four or five hundred acres in extent. All the equipments of these works involve the application of the most recent improvements in steam and hydraulic machinery.

A large pier is constructed in the river parallel to the banks, connected with the shore and the works by a viaduct carrying several railroad tracks. Large steamers come alongside this pier and are discharged with great rapidity by means of steam hoists placed below the deck of the pier, into trains of cars, which convey the coal directly to the retort houses. A complete network of railroad tracks enables every part of the works to be reached, both on high and low level, by steam cars. Some 15 locomotives are owned and used here by the company.

The retort houses are arranged with coal stores on each side, from which the coal is shoveled directly into the retorts. Foulis' mechanical stoker is used for drawing and charging in a portion of the works.

The settings are usually sixes. The retorts are D's and "throughs," made in three pieces, and joined in the setting. Coke cellars below receive the coke as it is drawn. They work with a seal, and use the self-sealing lid. The condensers, purifiers, etc., are in the open air. Very large works for the working up of tar and ammoniacal liquor were is progress of construction, the design being to convey the tar and liquor from the the other stations to this point for manufacture.

The works as designed are not yet all bullt, but are being extended each year.

Two 48-inch mains convey the gas to London, and much of the gas made in the day time is thus carried to different holder stations in the city. The holders are about 1½ million capacity each, but only a portion of those contemplated are erected. The capacity of the 48-inch mains is reached, and it is proposed to establish a pump-

ing station about three miles from the works, to increase the flow until such time as a six-foot wrought-iron main may be laid.

At several of the other stations of the Chartered Company *very* large works may be found, sending out six, eight, nine millions a day. Some very large holders, of two millions capacity, are in very successful operation; but when we compare the enormous business done, with that required of our works, the large holders are not so much out of proportion. One engineer told me that he had seen one of his holders, containing 1½ millions, emptied in 1½ hours.

At Fulham, and at St. Pancras stations, settings of tens of brick retorts are in use; some benches that had been in use for twelve years were still working and doing good service. The settings of tens, worked from a travelling stage, were necessitated by want of space; but I think otherwise were not found so economical as sixes or sevens. The Chartered Company last year carbonized, at all its stations, 1,051,323 tons of coal, made 10,728 millions feet, and sold 9,935 millions, or the make per ton was 10,205 cubic feet, and the sale 9,450 cubic feet.

Each of the different stations is under the direction of an engineer who resides at the works. This is the usual practice throughout England, although it is not always the case.

The next largest company, in amount of coal carbonized and gas made, is the Phœnix, which last year carbonized 163,478 tons of coal, made 1,652 millions of gas, and sold 1,539 millions.

The Manager of this company is Mr. Corbet Woodall, the late President of the British Association of Gas Managers, and under his direction the largest holder in the world is being constructed. It is 213 feet in diameter, telescopic, two lifts, of 44 feet each, and will hold 3,100,000 cubic feet. This company has three manufacturing and holder stations.

Time and space do not permit the giving of many details connected with these and other works; but I will mention the South Metropolitan as being remarkable for selling the cheapest gas in London, the price last year being 3s. 2d., equal 77 cents per M; the other companies sell at prices varying from 3s. 3d. to 4s. The more general price is 3s. 6d., or about 87 cents per M. The London Company has recently been introducing improvements in the handling of their coal. Heretofore, all the coal coming to the city was discharged from vessels into barges, below the bridges, and then floated up with the tide to the point where wanted. The London Company have had some large steamers constructed, with "falling" smoke stacks, etc., which pass up under the bridges to the company's dock, near the works, where they are unloaded by hydraulic cranes, and the coal run by rail into the works. The appearance of large steamers above the bridges was a novelty.

To give a general idea of the workings of the London companies, I propose to treat them as a whole, and from published reports I have taken certain statistics, and taken the *averages* of all the six metropolitan companies *for five years*. For general comparison with what you may be doing yourselves, this may answer quite well enough. In converting sterling into currency, for convenience of calculation I shall call the shilling 24 cents and the penny 2 cents.

*Items of Cost, etc., per* 1,000 *feet of Gas Sold, as shown by the Averages of all the Six Metropolitan Companies of London for the past Five Years:*

| | | |
|---|---|---|
| 1. The amount of capital employed per 1,000 cubic feet of gas sold was..... | 14s. 4d. = | $3.40 |
| 2. Price of gas per 1,000 cubic feet..... | 3s. 11½d. = | 95·00 cents. |
| 3. Cost of coal per 1,000 cubic feet of gas sold.... | 26·74d. = | 53·48 cents. |
| 4. Working expenses per 1,000 cubic feet of gas sold, which includes purification, salaries, carbonizing, wages, wear and tear, distribution, rent and taxes, management, law charges, bad debts, etc., | 18·18d. = | 36·36 cents. |
| 5. Residuals per 1,000 cubic feet of gas sold..... | 15·09d. = | 30·18 cents. |
| 6. Gas sold per ton of coal carbonized..... | | 9,035 cu. ft. |
| 7. Gas unaccounted for, per cent. on make (4 years)..... | | 7·07 |
| 8. Bad debts, per cent. on gas and meter rentals..... | | ·52 |
| 9. Net proceeds of residuals, per cent. on cost of coal..... | | 56·19 |
| 10. Profit on gas, per 1,000 cubic feet sold..... | 15·48d. = | 30·96 cents. |
| 11. Net profit per 1,000 cubic feet gas sold..... | 13·93d. = | 27·86 cents. |
| 12. Dividend (standard) per 1,000 cubic feet sold..... | 13·43d. = | 26·86 cents. |
| Per cent. on capital, about..... | | 7·8 |

*Recapitulation.*

| | |
|---|---|
| Cost of coal per 1,000 cubic feet of gas sold..... | 53·48 cents. |
| Working expenses..... | 36·36 cents. |
| | 89·94 cents. |
| Less residuals..... | 30·18 cents. |
| Cost of gas less residuals..... | 59·66 cents. |

*Price of Labor.*

The average price of labor has been—

| *In London*, 1878. | | *In New York*, 1873-78. | |
|---|---|---|---|
| Stokers..... | $1 32 | Firemen..... | $3 12½ |
| Laborers..... | 0 96 | Helpers..... | 2 54 |
| Bricklayers... | 1 44 | Bricklayers... | 3 12½ |
| Carpenters... | 1 44 | Carpenters... | 3 46 |
| Blacksmiths.. | 1 32 | Blacksmiths.. | 3 37½ |
| Fitters..... | 1 36 | | |
| Service layers. | 1 20 | | |
| Lamplighters. | 0 72 | | |

*Price of Coal.*

| | | |
|---|---|---|
| Average cost of coal per ton in London, 53·48 × 9,035..... | | $4 83 |
| Average cost in New York for five years..... | Cannel... | 11 63 |
| | Caking... | 6 54 |
| | Province. | 5 16 |

From these figures (which are official) each one of you can calculate the relative cost of your own gas delivered and that in London; and, although I am not able to speak from actual knowledge in any one case, much less in a general way for a series of years, still I am under the impresion that, when due allowance is made for difference in cost of coal and labor, and the difference in the receipts for residuals, it will be found that gas is made as cheaply (in proportion) here as in London. I may be wrong in this; and, if so, I am ready to be corrected. These are points that we need carefully collated statistics upon, which, unfortunately, we have not got. I hope this Association may soon have sufficient confidence in itself to begin the collection of such data.

A few words as to what may be termed the Police and General Managent of the working parts of the system of gas making in London.

The general cleanliness of the works was fair, but in many cases much more attention seemed to have been paid to the appearance of the engine and exhauster rooms than to other parts of the works. At some of the stations these parts of the works were a perfect delight to look upon, and one felt loth to leave them, while justice compels me to admit that, at other works, these and every other part were in such an untidy condition as I trust would be seldom seen here—or if seen here at all, they should not be commended by any gas manager.

As to the purification in London, it is simply absurd. The manager has, in fact, very little time to do anything but watch his purification. The restrictions, in some cases as hard as 15 grs. S. in 100 cubic feet, are simply absurd. In lighting the gas through a house with our ordinary sulphur matches, more sulphur would be set free than from 100 feet of gas with twice this amount. When asked by the gentlemen there what our limit of S. was in this country, I simply replied, we light our gas with sulphur matches.

At the meeting of the British Association of Gas Managers, Mr. Thomas Wills, F.C.S., delivered a lecture on the products of combustion, and on the sulphur question he remarked as follows:

"With regard to the question of sulphur in gas. You remember we concluded a short time ago that the air of a room must be constantly changed, or we could not exist, and that the change must be going on several times in each hour; the whole atmosphere must be changed generally more than three times in each hour. Now, supposing sulphur is burned into sulphurous acid, and that it exists for even a part of an hour as such in the air uncondensed, it will come under the ventilating effect, and will undergo removal just in the same way as the aqueous vapor or the carbonic acid present in the air. If one-half of the sulphur remains in a gaseous condition for only one hour, it will be entirely removed within that period. I believe most of the ordinary effects which are attributed to the presence of sulphur in coal gas, and the damage that it does, are quite easily accounted for by other things. I believe the constant drying and wetting, coupled with the elevation of temperature and the presence of carbonic acid—effects which result from all illuminating fuels alike—are quite competent to account for the greater amount of damage which is represented as being solely due to the presence of sulphur. If we regard the absolute quantity, the figures become exceedingly minute, even if you have 20 grains of sulphur in 100 feet of gas. Supposing it to exist in the form of bisulphide of carbon, here is such a quantity of bisulphide containing 20 grains of sulphur. The quantity in this little tube, about an inch of it, represents 20 grains of sulphur, or the amount which we may take as being present in 100 cubic feet of our London gas. Now I could, if I had time, burn the whole of this quantity at once, and you would have all the sulphurous acid from it discharged into the air, and that would represent the sulphurous acid from 100 cubic feet, but I believe it would be impossible for you to find out the sulphurous acid, although it is there. Undoubtedly it is there, but it is diluted to such an extent that you could not find it by any ordinary test.

"If 20 grains of sulphur burn, they form 40 grains of sulphurous acid; a cubic foot of sulphurous acid would weigh 1,184 grains. Now, the thirtieth part of a cubic foot of sulphurous acid is produced by 20 grains of sulphur, or the amount in 100 cubic feet of gas, and I may say that such a quantity in this room, supposing the room to contain approximately 60,000 cubic feet, would be represented by the block I hold in my hand, about 3¾-inch cube, and which, if diffused through the entire room, would amount to about one-half part per million in volume, or about ·000001 per cent. in weight.

"If a proper arrangement were adopted to carry off the products of combustion, there would be no more complaints of sulphurous acid, and I believe that proper care ought always to be taken that coal gas should not to be burnt, in anything like quantity, without such arrangements being adopted. If this were done, all danger from damage by sulphur, even if it existed in greater quantity than it does, would be at an end; but I expect it would be found, supposing you could find out how to take the whole of the sulphur out, the complaint of the damaging effects would continue for some time, just the same.

"I may say, with regard to the percentage, it has been found that in the Manchester atmosphere, over

a range of four miles, the amount of sulphur present normally in the air would be equal to the quantity which would be formed in this room by the presence in it of this amount of sulphurous acid; consequently, the whole atmosphere of that town we should expect to be doing damage by sulphur. If we regard the amount of coal burnt in London, 8,000,000 tons per annum, and if we take that coal to contain 1 per cent. of sulphur which is burnt—whether in the form in which you send it into houses in gas, or in furnaces, or in grates, it is burnt away in some way—and which is a low average, we shall have 80,000 tons of sulphur thrown into the air in the form of sulphurous acid, and if that is calculated into oil of vitriol, it will amount in one year to 240,000 tons of oil of vitriol sent into the atmosphere of London alone by the combustion of coal."

The extent to which the sulphur question is carried there seems like a refinement of science rather than a useful, practical protection of the public. The gas companies are tied down to the extremest limit on grounds of public health, while thousands of houses are annually flooded with high tides, heavy rains, etc., which sweep into permanent lodging places within the habitations of the poor the refuse—sometimes even the back-water—from sewers and drains. All of which results from imperfect provision for taking care of this kind of impurity by the same authorities who hold up their hands in holy horror and exact a fine of £50 upon the unhappy gas company every time they can find "an excess of sulphur."

A very singular fact exists with reference to the sulphur impurities. The moment a city or municipal corporation acquires the possession of a gas works in England, all these restrictions disappear, and are no more spoken of. Bearing in mind the continued anxiety of the London manager on the purity question, and that in some cases test analyses are made every hour, it is not strange if the details of the retort house received less attention. I think that with us the motto is, "In the retort house is where the money is made;" or perhaps more justly it may be said, "the retort house is where the money is *saved*." It did not appear to me that there was as much economy there as with us.

The charges are all "six hours;" the retorts are all "throughs." In several works 20 men did the work for 96 through retorts, 192 mouth-pieces, in twelve hours, or 4·8 retorts per man for 24 hours. This includes drawing and charging, and quenching coke and throwing it back in the cellar. But the coal is in coal houses alongside the retort houses, and has merely to be picked up and put into the retort. There is no bringing coal or hauling out coke in this estimate, for it does not have to be done. The coal is there, and the coke goes into the cellar.

The buildings of some of the more recently constructed works are very handsome and substantial structures, wherein beauty of architectural design has been combined with practical utility. Against this most commendable practice there are not wanting those who complain that if the companies did not spend so much money on buildings, they would not have to pay dividends on so large a capital, and, consequently, they could sell gas cheaper. This, too, from a people who get good 15 candle gas for 87 cents per thousand, and do not burn it in any place, where they can avoid it, in their houses. Truly, it is somewhat difficult to please the ordinary gas consumer.

The use of gas in dwellings is usually restricted to the lower parts of the house; and, either in hotels or private houses as you mount the stairs to retire, you are often confronted with a table filled with brightly polished candle sticks containing the "one candle power" that is to enable you to complete you correspondence, read your bible, and see you into bed.

In this fact (which must some day cease to be a fact) as well as the natural increase of population, and the steadily increasing application of gas to heating, cooking and mechanical purposes, is to be found the cause for the steady and rapid increase in "gas sold,' that is found in London. This, I believe, will continue to be the case; and neither will the "electric light," nor petroleum, convert the now busy places, where gas works stand, into vacant lots or grass grown wastes waiting other occupants.

Mr. Neal—Do you mean to be understood that the price at which gas is sold here is cheaper, in proportion, than the price charged in London?

Major Dresser—That is a point that I do not wish to be misunderstood about. I tried to word that phrase very carefully. I say "I am under the impression that, when due allowance is made in the cost of coal and labor, and the difference in receipts for residuals, it will be found that gas is made as cheaply, in proportion, here as in London."

I am talking to a body of gas makers. My object in collecting these figures has been to get reliable information, and put it before you, so that each man can take the items and calculate for himself, and see exactly where he stands, in comparison with London makers, so that, when people say to him, "Why, they sell gas at 90 cents in London," he will be able to have an intelligent answer to make, and he will be able to know whether he is right, or whether he is wrong.

There is one thing I omitted to say, and that is that the statistics I have given here have been for the entire five years. It is interesting perhaps to note what the improvement has been in carbonizing during that period. Taking the results which I have summarized, we have the following figures:

Amount of gas sold per ton of coal carbonized (this is for 1873), 8,575; for 1877, the amount of gas sold per ton of coal carbonized, 9,333. These figures show that they are not standing still on the other side any more than we are.

Mr. McIlhenny—Do you speak of ton of 2,240 pounds?

Major Dresser—Yes, sir.

Mr. Greenough—It is not my intention to endeavor to add anything to the paper which Major Dresser has read, and which has been listened to with so much interest. But there is one point which, although he touched upon it, is worthy, I think, of a little closer attention.

Comparing the price of gas in London, and in this country, a very important question comes up, that was barnly dwelt upon sufficiently in his paper, and that is the interest on capital.

Major Dresser—I gave the amount of capital invested in London, per 1,000 feet of gas sold—$3.40—from which every man can calculate for himself.

Mr. Greenough—That is true, but at the same time its importance was hardly made sufficiently prominent. I had the pleasure, this summer of hearing Mr. Livesey read a paper upon the proportion which the amount of capital invested in gas companies should bear to the amount of coal carbonized. Taking a large number of English companies, the conclusion he arrived at was that any well-ordered, and economically-directed company, ought not to have a capital of more than £5 per ton of coal annually carbonized. I do not believe there are any companies in the country that can show such figures as that. Taking our own company, for example, which I think does a large business, the relation of capital invested to the amount of coal carbonized would be about, £10 per ton. That, as everybody can see, is a very large matter, having a material influence upon the cost of gas in this country.

I do not know that it is necessary for me to add my opinion to what Major Dresser has said in the way of comparison between the efficiency of our works on this side of the water, and the works upon the other side; but I think he is entirely justified in every comparison he has drawn between their retort house works and our own. The engineering arrangements of the works in England are on a much larger scale than those in this country, and the quantities of coal to be handled are very much greater. The process by which hand-power is saved, the coal distributed, and purification carried on, is such as to call forth the admiration of everybody who sees it. But when you go into the retort house you are surprised to find that people who are so careful at the spigot are wasting so much at the bung I think the greatest mistake our friends on the other side make is in giving so much more attention to purification than to the retort house, where, as Major Dresser says, our money is saved. I will simply mention one fact in this connection, which I think the members of the Association will appreciate at once. At one of the large works which I visited the hydraulic main, which we are in the habit of watching pretty carefully in this country, was set on brick piers, built on the benches, and of course the main had settled or lifted with the bed and the consequence was they had a heavy seal on some dip-pipes, while others would have very little. I think that will serve fully as an illustration of what I mean.

I have taken the liberty of saying these things, thinking they might be of interest to the Association; but having opened my mouth on the subject, I do not want to sit down without expressing in the strongest language my appreciation of the hospitality with which we, as Americans, were received in London this summer. I had the pleasure of being with Major Dresser and Mr. Forestall, of New Orleans, and there was nothing which the people among whom we went could have done that they did not do to make our reception of the most cordial and friendly nature. They extended to us every hospitality; they showed us around their works, and gave us all the information they could; they invited us to their homes, and they evinced the highest degree of interest in everything that was being done on this side of the water. And I have no doubt but that any gentleman of this Association, who went there properly indorsed, would have received the same kind of welcome which was extended to us, and which made so great an impression upon us.

Mr. Price—I am very glad Mr. Greenough has made the remarks which we have just heard. As I understand the rules of our Association, after the reading of any paper the whole subject is open for discussion. He has alluded to a point which I feel a great deal of interest in. A gentleman asked me to-day, just before this meeting was opened, what I considered the elements of cost in making 1,000 feet of gas. I hope that trail will be followed up.

Mr. Neal—I understand that Mr. Forestall, who was with Major Dresser and Mr. Greenough on their trip abroad, spent a great deal of time in the examination of the Paris gas works. He is prevented from being with us to-day by the ravages of the yellow fever. I understand that he had prepared, or was to have prepared a very interesting paper upon that subject. to be read to us; and perhaps, in this connection, it would be well for Major Dresser, in the absence of Mr. Forstall, to give us some account of the Paris works.

Major Dresser—I would say that when Mr. Forstall was absent, Mr. Greenough was the Frenchman of the party.

Mr. Greenough—I think it hardly fair that any individious remarks should be made about the exceedly small proportion of the French language that I am familiar with. In reference to the Paris works, I would simply say that Mr. Forstall was in Paris very much longer than I was, and he devoted much more study and attention than I did to the Paris gas works. I understood that he was to prepare a paper on that subject to present to this meeting. The number of gas works in Paris that I visited was very few indeed. My principal object, while in Paris, was to familiarize myself as much as possible with the working of the electric light, and not in any way to bestow careful attention upon the details of gas manufacture, and I was at only two or three gas works, and made but a very cursory examination of them. The necessity of utilizing their coke is so much greater than it is with us, and it is so much more important for them to save every pound of it that they can, that they have devised, as you all know, the most ingenious plans for saving it, and at the same time obtain-

ing very high heats. The average temperature of their retorts was 135° C, or 2,500° F. Their retorts are 25 × 10 × 9 feet, and they are charged every four hours with about 270 pounds of coal. Their works present a singular contrast to the London works; and the impression which was left on the English engineers, who visited Paris in company with us, was very great, especially when they found that in the works which we visited they had 1,100 retorts, and were making about 8,000 feet from each one of them, and that, too, with the use of only about 25 per cent. of coke as fuel; and I think that in the works where they were using either the Siemens furnace, or another similar one that was arranged by themselves, they saved about a quarter of that 25 per cent. The utilization of the residuals, coke, ammonia, etc., is so much of an object to them that the chief engineer of the Paris company, M. Arson, told me that his residuals paid him not only for the manufacture of his gas, but also for a very considerable portion of the cost of distribution. That is a result, the bringing about of which, I think, we should hail with enthusiasm in this country.

The impression left on my mind, after visiting the works in Paris and in London, was that if we were to take the French retort-house, and the English purifying apparatus, and run them in conjunction, we should have pretty nearly a perfect set of works. At the works at La Villette, the arrangements for purification were singularly simple and small as compared with those of the great London companies. It is my recollection that the only purification to which the gas was subjected was that of oxide of iron. Charging, as they do, their retorts every four hours, instead of every six, as the English do, it was contended by the French engineers, and, I must say, I think with entire correctness, that the amount of bisulphide of carbon was very much less in the French gas than in the English. That assertion was at once contradicted by the English engineers who were present; but it is my impression, notwithstanding, that the Frechmen were entirely right.

I have very little to say on the subject of these French gas companies. The relation of the Parisian companies with the public I suppose you are all familiar with. It simply amounts to this, that the Parisian company, in 1853 or 1854, contracted to supply Paris with gas for fifty years. They sell to consumers at a price equal to about $1.75 per 1,000 feet, and they supply the street lamps at half that price, I think. They are allowed to pay 10 per cent. dividends to their stockholders, to provide for a sinking fund, with which their stocks shall eventually be redeemed, and also to provide for all repairs that are necessary; and then any extra dividends which they pay beyond that they are required to divide equally with the city of Paris. That, of course, gives the city the interest of a partner of the company. The amount of money which was paid to the city of Paris last year by the companies was, I think, 8,500,000 francs, which a little more than paid for the gas they burned. You thus see that they made some money by the operation.

Major Dresser—They paid for the gas they burned at about the rate of 87 cents; then what they got from the division of profits, over and above the authorized dividends of the company, a little more than paid for the gas they used. So that, under such a condition of things, it will be seen that it is to the interest of the city to burn as much gas as possible. The more gas they burn, the more money they make. [Laughter.]

Mr. Greenough—On the night of the great illumination in Paris, celebrating the anniversary of the Republic, when I happened to be there, the engineer of one of the companies told me that they were ordered by the city to furnish gas for 400,000 extra lamps that night. I believe that is all I have to say upon this point at present. I shall be glad to answer any questions that may be asked, so far as I am able to do so. One thing I had forgotten to say, and that is, they make the most beautiful exhibition of their residuals at the exposition.

They not only work their coal tar and ammonia water into ordinary products, but they also produce a species of fuel, which is extensively sold throughout the country at very great profit, as I understand. Using their coke dust, and, I think, their coal dust, and mixing with it the residuals of their tar stills, they produce blocks of this compound, which are perhaps about 12 inches square. These they sell to railroad companies for fuel. They are very easily stored on the tenders of engines, and you will see them in piles of thousands of tons around the large railroad stations in the vicinity of Paris. The working up of their residuals is carried on in the most exquisite way, and the products which they show are such as to excite astonishment that they can be produced from a source we are all so familiar with, and from which we get so little. They make the most beautiful exhibition of their products in this line. We had the pleasure of being present at a luncheon which was given to the Société Technique, and also to the British Association of Gas Managers. The tables were spread in the new retort house belonging to the Parisian company, at Ivry. I think the gentlemen who were present were very much surprised to see the extraordinarily beautiful trophy which was there exhibited. It was on the brick wall at the end of the building, the extraordinary construction of it you would never notice until you came to pick it to pieces and see what it was composed of—rakes, stand-pipe augers, shovels, etc. I would like to say, in this connection, that the hospitality with which we were received in England was fully equaled by our reception at Paris. Nothing could exceed the courtesy and cordiality with which we were treated. I might say a good deal about electric light, but you will hear enough of that.

Mr. Price—It has been said that they manufacture all their material.

Mr. Greenough—They manufacture their retorts and fire-brick, not only for their own works but for works at other places. They also sell some retorts.

Major Dresser—They make everything that they use. They make their own holders, their own fire-brick, etc.; and not only that, but they make gas stoves and gas engines, and anything that will increase the use of gas.

Mr. Neal—Do they make money by the operation?

Major Dresser—I don't know; I did not get any from them.

Mr. McIlhenny—So much has been said by the gentlemen who have just addressed you in regard to the manner in which they were received across the water that I am tempted to say a few words upon that subject. I visited Europe three years ago, and I rise now simply for the purpose of making a statement that I have made privately to a good many members of the Association, in regard to the reception I met with. The expressions of the gentlemen who have been there since have been so unanimous with regard to the overflowing and spontaneous hospitality with which they were received that I fear it is perhaps very ungracious for me to tell about the cool reception that I met with over there—in fact, no reception at all. They let me severely alone, and I could not account for it; but since Major Dresser has come back it has all been made clear. He told me that he was told by the people over there that there was a gentleman visited them by my name, but that they thought he would not live to get back home. I think perhaps the lack of attention on their part toward myself was due to the fact that they were afraid I would die on their hands, and they did not want a first-class corpse over there. [Laughter.]

Major Dresser—I would like to say one word in reply to what Mr. McIlhenny has said, and that is that the treatment that I received (and, so far as I have heard, the treatment that was received by the other gentlemen who were over there), from the moment I landed in Liverpool till I left, was of the most hearty and cordial character. Everything that these gentlemen could do in the way of giving information and allowing me to examine their books and papers, was done. Not only that, but they assured us that if at any future time anything came up in regard to which American gas companies wanted any information, they would give us all it was in their power to give. We were invited to their houses, and were treated in the most sincere and courteous manner in every way, and I cannot conceive of anything being more hospitable than these people were to us on every occasion. In going into small villages, and into gas works where I was entirely unknown, by simply announcing myself as from America, and interested in gas matters, I was immediately received with the greatest cordiality, and shown everything. There is no single instance where there was any different treatment received by us. The feeling seemed to be that they could not do enough to return the hospitality that had been shown not only to the members of the gas profession, but to other English gentlemen who had been in this country; and there was the greatest desire on the part of all to promote good feeling and increase their acquaintance with gentlemen from this side.

Mr. Price—We would like to have Capt. White state how he was received. Let us hear from all sides of this matter.

Capt. W. H. White—I do not think it is necessary to again inflict upon this Association a narration of my experience upon the other side. It was certainly very pleasant. I had the advantage of beginning earlier than Major Dresser, and ending later. They took me ashore at Queenstown, and there they commenced a process of hospitality which they continued without intermission until I got around from Queenstown back to Liverpool. The last gentleman who saw me on board the steamer and asked me down stairs was a gas man, and the very first man that I took by the hand when I landed on the other side was a gas man. [Laughter.] I was received with the greatest courtesy and cordiality wherever I went. I had an opportunity to look into their methods of working, and I was shown over their works, and was shown their books, and was given all the information I wanted. It was only necessary for me to present my card and to say that I was an American gas man, to insure a cordial and hearty welcome. Their wives visited my wife, and every attention was shown that a refined hospitality could suggest.

I found some small gas works containing one retort, and I found the same courtesy there, and the same willingness to give me information that I found at the immense works at Beckton, where I was shown every courtesy and furnished every opportunity to make the fullest investigation. There seemed to be a rivalry among all the gas works I visited as to which could treat me the best and show me the greatest kindness. I am sure I cannot fitly express my appreciation of the manner in which I was received everywhere. I am at a loss to understand why it was that Mr. McIlhenny was so cooly received. He accounts for it upon the theory that they thought he might possibly die on their hands. I don't look at it in that way. They probably thought that if he did die on their hands it would take all the good whiskey in England to preserve his body and send him home, and for that reason they were anxious to get him out of the country while he was yet alive. [Laughter]

Mr. Denniston—I would like to call attention to one thing suggested by the remarks we have listened to. I think we all ought to try and get the consumers interested in the prosperity of the company. I have tried to do that by charging them $2.50 per 1,000 for gas, and giving them 20 per cent. off, so that, as Major Dresser has stated regarding the city of Paris, the more gas they burn the more percentage they get off. I think it is a first-rate idea to give them some such inducement to burn more gas.

Mr. Neal—I think the paper which has been read by Major Dresser, and the remarks of Mr. Greenough, suggest a subject which is very interesting to us—namely, the utilization of residuals. In this country, why is it that our residuals do not command a greater price, and can there be any way devised by which

they may be made more acceptable to the public, so that the gas companies can realize more from them, and in that way be in receipt of a revenue or income which will enable them to reduce the price of gas. It would seem as though there ought to be some means devised by which the farmer could be instructed in the use of spent lime and other residuals. I understand that in London the lime, after leaving the purifiers, brings a very good price indeed. So, also, with our other residuals, coal tar, etc. But if we could only sell our residuals at a fair price, we might give gas to our consumers at a much less price. Take, for instance, the sale of ammonical liquor. Some persons present have attempted to utilize that. Mr. Sherman tried it, and he says it was a failure. Mr. McIlhenny is, I think utilizing ammoniacal liquors at his works, and I understood that at one time it was very profitable. I would like to know whether that is the case now. I know I have tried to get several parties to take our ammoniacal liquor, and have given it to them at a fair price, but in every case it proved a failure. They would take the liquor for a while, paying a small sum for it, but in a short time they have abandoned it altogether.

Mr. McIlhenny—On the subject of the sale of ammoniocal liquor. I will say that we are still selling it to advantage. We sell our liquor at the rate of about ten cents per ton of coal carbonized, making an aggregate of about $2,700 a year that we are paid for the manufacture of ammoniacal liquor. It has been a very profitable business. We are now putting up an acid chamber for the purpose of making acid. I think nearly all the companies of any size in this country are selling ammoniacal liquor. Of course the production of ammonia from ammoniacal liquor is very much like the production of gas from coal—it depends upon the yield you get. It takes so many pounds to pay expenses, and beyond that is profit, so that if you can get a good yield you can get a good profit. That is true in making gas from coal, or any other source. We are utilizing our residuals in that respect very pleasantly, and, I think, quite profitably.

Mr. Young—I think the great trouble in many cases is the lack of interest that we take in making our ammoniacal liquor of the proper strength, so that parties engaged in using it can make its use profitable. That, it seems to me, is the most important part of the business—to make the ammoniacal liquor so that it can be utilized by those desiring to purchase. We sell our's now, and get eight cents per ton of 2,000 pounds for it.

Mr. Price—I will give you an account of my experience upon this point—in regard to the sale of ammoniacal liquor. A German came to our place five or six years ago, and proceeded to erect works for producing ammonia, and for utilizing our ammoniacal liquor. We made a bargain with him, by which he expected to give us about twenty cents a ton for ammonia, and we were to give him ammoniacal liquor at a certain strength. I think it was a sixteen-ounce or a fourteen-ounce liquor, but perhaps I may be mistaken about that. At any rate we were to give him the liquor at a strength at which he could work it profitably. It turned out that he did not know very much about the business, and when he came to get his works in operation he found that he could not pay any such price for the liquor, and that he could not get the cost of it back again. That was owing, however, partly to the fact that the price fell very rapidly. At that time in Cleveland sulphate of ammonia was worth about 6½ or 6¾ cents, and I think he made sales at even less than four. I did not want to have the works stopped, and so, in order to keep them going, and in order, if possible, to see if it were practicable to utilize ammoniacal liquor, even though we did not get a very good price for it, we finally agreed to let him have it at ten cents a ton, and we gave him the use of the building in which he carried on the operation. But I don't think he could really afford to pay more than six or seven cents, perhaps, to the ton.

Now, the great reason why ammoniacal liquor is not profitable, is, first, because ordinarily it is not made strong enough to justify working it; in the next place, because, as fertilizers are so little esteemed by the American farmer, the prices are very low. The western farmers have such rich lands that they do not care for fertilizers at all. In New England fertilizers are of course much more highly esteemed. But take the country at large, and especially all the western country, fertilizers are not greatly in demand. There is another residual upon which gas companies rely, and that is coke. Its value seems to differ in different locations. With us it has been a very valuable residual, but we are being interferred with by the low price of anthracite coal. We are now getting eight cents a bushel where we used to get ten and eleven. But in order to make it more attractive, and to fit it for the market, I purchased last year a cracker, or crusher, which is run by a small steam engine, and which reduces the coke to small pieces. In that way I have succeeded in changing the market, because there are a great many more people get it now in that way than purchased it previously. The cracker reduces the measurement as a matter of course. We calculate that we lose in the measurement about 12½ per cent. by cracking—being equivalent to about one cent per bushel. We charge an extra cent for cracking. We sell the ordinary coke, for instance, at eight cents, and sell the cracked coke for ten cents. It is gaining in favor every day. We find the sales increasing, and the coke appears to be much more acceptable in that form. I mention the result of our experiment that others may have the benefit of it. I thind it will be found to help the sales of coke very materially.

A Member—How much does it cost a bushel to crack it?

Mr. Price—Perhaps half a cent. It depends entirely upon your facilities, add whether you have to employ new labor, and whether you can make use of what you already have. I don't think it costs us over half a cent. We are pretty well paid for setting up our machine and running it. The machine is made in Indianapolis, and the name of its maker is G. R. Root. That is perhaps the best machine that is made—that is, so far as my knowledge extends. It is quite effective. I will say, however, in passing, that, although he is probably entirely honest, yet I was misled by his statement that the coke would increase in volume after being crushed, although I did not exactly see how that could be possible. I was not quite able to understand how, when it was reduced to a small compass, it could measure more; but still, I took his word for it, and was disappointed when I found the reverse was the fact—viz., that it dimished the measurement. But I finally concluded that, buying, as he did, his coke from Louisville and Cincinnati in large quantities, he probably got very large measurements, and therefore it was very likely true that, considering these large measurements, in buying and selling so many hundreds of bushels he actually gained a little, and I accounted for it in that way. I think he is an honest man; I don't think he meant to mislead, but you will find in running the coke through the cracker that the volume will be diminished, and that you will lose about one bushel in eight. The dust is very small indeed. The cracker cracks the coke into pieces about the size of walnuts and butternuts. The expense of the machine is about $250.

Mr. C. White—Speaking of residuals, and especially of coke, calls to my mind a little experience of my own in that line. Owing to the low price of anthracite coal, we have had considerable difficulty in getting rid of our coke. There is a hill probably a half a mile, or nearly that, in length, which we must ascend before we can reach the top of the main level of our city. Our people did not seem disposed to come down and buy the coke, and a large amount of it accumulated. I heard of this crusher of Mr. Root's, and suggested to our company that we should send to him and get some information on the subject. We did get a circular from Mr. Root, in which he gave large results in relation to what could be done, either by hand power or by steam power, from this crusher. We ordered one on the strength of that, to be tested and paid for if found to answer our purpose. I took great care, in putting it up and testing it, that everything should be made to work as fairly and as smoothly as possible. He claimed, I believe, that four men in ten hours could crush 1,200 bushels of coke by hand. I put two men to work on it—one to shovel the coke into the hopper, and the other to turn the crusher. I found that after one or two revolutions the thing refused to go with one man power, and I put two men at it at intervals: but it did not do any better. No four men can begin to crush in that crusher 1,200 bushels of coke in a day. I merely give you my experience as to the working of the machine *by hand power;* how it works by steam power I can not say, because our facilities are such that we cannot use a steam engine.

Mr. Price—I should hardly think it would be worth while to set up the machine unless it was used in connection with a steam engine.

Mr. C. White—There are a great many of us that have not the facilities for running an engine in connection with the crusher. The result of my experience with the Root crusher was that from it I got an idea of how I would better it, and I went to work and got up the patterns, though I have not applied for a patent. I hope it is understood that I am not selling a coke crusher. I make these statements simply for the reason that I think my experience in the matter of crushing coke may be of interest to the Association. Mine is a cutter and not a crusher, and its operation has proved very satisfactory. I find there is a loss in measurement of about 10 per cent.

There was another fault I found in Root's machine. The balance wheel weighed about 50 pounds. It was of no assistance whatever in working the machine. I made mine 300 pounds, which I found was a very great improvement; so much so that one man can stand on a platform and turn the wheel rapidly without trouble, while another man shovels out the coke. I can crush 1,500 bushels of coke in one day with the machine in this way. I have figured the additional cost of crushing the coke at 1 1-3 cents per bushel, which covers everything. I find, also, that it makes a great deal less dust than the other. In fact, I have it so arranged that the coke, as it comes through the crusher, falls upon a screen and, running down, sifts itself. By this means my coke is perfectly clean when it is delivered to the consumers. There is one thing I have not yet been able to succeed in doing, and that is in getting our people to put the price of this crushed coke up. We have so much on hand that they think it would be better for us to get rid of it, even at the loss of 1 1-3 cents. Therefore, we are to-day delivering that coke at just the same price as we are delivering the other.

Mr. Price—Do you sell any more?

Mr. C. White—Very little; but we only got this machine up, and in operation, week before last, and, of course, we cannot tell much about it.

Mr. Price—Of course. I do not pretend to say that there may not be some better machine than Mr. Root's; but when it is run with a light steam engine, it does very good work. We have it arranged so that the coke falls upon a screen, and the dust, consequently, falls upon one side, and the coke is upon the other. Have you patterns for your machine?

Mr. C. White—Yes.

Mr. Price—Mr. Root's machine does very good work for us under the conditions I have named—run with steam power; still if there is anything better I think we are all interested in knowing what it is.

Mr. White—I have not had it patented, and have not even applied for a caveat. The idea just came into my mind from seeing the defects in the other. I thought I saw a way of remedying them, and I set about trying what I could do in that direction. I worked out the patterns and put the machine up, but, as I say, I only succeeded last week in getting it into

operation, and have used it for only two or three hours at a time. I have, however, all the coke crushed that I can store away in what little space we have.

I do not wish to say anything against Mr. Root's machine. It may work very well with steam power (and we have Mr. Price's word for it that it does), but it certainly does not work well with hand power. Neither do I wish to appear to be speaking in favor of the machine I now use. I am simply stating results.

Mr. Price—What is the expense of your machine?

Mr. White—I could not tell. It would not be over from $85 to $95. I have not determined the matter of price as yet.

Mr. Nettleton—I have also had a little experience, and it came about in this way: Our town is a small one, and our consumption is of course somewhat limited. The centre of population is at some distance from the works, and we depend a good deal upon the inhabitants of the immediate vicinity of the works for sale of our coke. We found that we could only sell our large coke to the factories, but in consequence of some of the factories not running last winter, it accumulated to some 4,000 or 5,000 bushels, which, for us, is a arge amount. I heard that Col. Steadman, of Newport, was doing something in the way of breaking up coke, and also Mr. Slater, of Providence. I asked both of these gentlemen how they did it. Col. Steadman gave me a slight sketch of the means he employed, and the results; and I went and got a Newport machine. It cost me $55, without the fly-wheel. I picked up a fly-wheel that answered my purpose sufficiently well, and the whole cost did not exceed $65. We run it with a small four horse power engine. It will break coke as fast as two men can shovel it in. I arrive at the loss in measurement in this way: I measured up 200 bushels of large coke as it came from the retorts, and after it had been put through the machine I had 179 bushels of broken coke, and 9 bushels of dust. I estimated the cost to be, including extra labor, at from 1½ to 2 cents. But it brought about this result, that there is a great demand for all of my coke. I have a very small amount on hand, not enough to last me more than two weeks, and before I got the crusher I could not sell my coke.

Mr. Harbison—I think the great difficulty is that gentlemen who complain of not being able to dispose of their coke, do not make a good quality of coke. We have no trouble whatever to dispose of our's. We have got orders enough on our books for all the coke we shall produce in the course of six weeks. Even during the summer I am sometimes obliged to send to New Haven for coke to keep our customers supplied. It is brought by water and by rail. As I said before, the trouble is that the gentlemen do not make good coke.

Mr. Price—Perhaps Mr. Harbison will tell us how to make good coke.

Mr. Harbison—Buy a good quality of coal, burn it for the proper length of time in properly constructed retorts, take all the gas out, and you will have good coke.

Mr. Price—I will say one word on that point. I am convinced there is a great deal in what the gentleman from Hartford has said. In the first place, unless you buy a good quality of coal, you will not have good coke. There is a great deal of coal used that is utterly unfit for gas purposes. It is used for various reasons: sometimes because it is very cheap, sometimes because stockholders of the gas companies are interested in the coal companies that sell this cheap coal, and sometimes because they are interested in the railroad that carries it. There are a multitude of reasons why some gas managers use poor coal, but in my judgment it is a mistake. The best coal is, I think, generally the cheapest, even though it may cost something more. We use Youghiogheny coal, and I do not think there is any better coke made in the United States, with all due respect to my Hartford friend. But just across the river from us, not more than a hundred rods distant, where they were using a different coal, there was a good deal of complaint about the coke they made, and the people who naturally would have bought coke from them came to us; and when we asked them why they came to us to buy coke, they said it was because the coke at the other works was not good. I think it was partly because they used poor coal, or, at any rate, inferior coal; and partly for another reason, which sometimes may hold good in other works besides those I refer to, and that is this: the works were small, and the men who had charge of the coke and threw it out went back to the fill retorts. The works were not large enough to employ sufficient labor, so that a number of men could be filling the retorts while the others were taking care of the coke. The result was that the coke was neglected, and was left to take care of itself while the men were filling the retorts with coal, and consequently it was often burned. Of course we all know the importance of taking proper care of the coke, and taking it out just at the right time. If this is neglected, of course we cannot expect to get good coke. I have said this because I think the observance of proper care in this respect is almost as necessary to the successful handling of the coke after it leaves the retort as to have a first-class quality of coal.

Mr. Breese—I suppose a good many members of this Association know how to make good coke. For my own part, I would like to know a little more about making ammoniacal liquor. I would like to know what strength it should be made in order to be most useful to those who may desire to purchase it, and what the cost would be in economically managed works. I can make coke, probably, as well as the rest of the members of the Association, and sell all I can make, but I do not know a great deal about making ammoniacal liquor, and some of my friends do not know much more. I, for one, would like a little more information on the subject, and if Mr. McIlhenny or Mr. Price, who have had considerable experience in making ammoniacal liquor, would give us a little more in detail their results in regard to the amount they can make per ton, the strength that it should be made, and what it cost to make it, they would help some of us very much.

Mr. McIlhenny—I think there has been rather too much stress laid upon the amount of information I possess upon this subject, but what I have I am perfectly willing to give to the members of the Association who desire it. In the first place, to make ammonia you must have facilites. These facicities consist of *effective scrubbers*. It will depend largely upon the efficiency of the scrubbers as to the quantity that can be produced per ton of coal. There is no cost, I may say, in producing ammonia. All that is required is a pump, to pump the liquor over. It is one of those things that come voluntary, as it were. The way that we manage it is very simple. We have two scrubbers, 46 feet high by 12 feet in diameter—plain cylinders filled with slats. These slats are about 4 inches wide, and are laid flat; and each slat protects the opening of the one below it. This is a much better plan than to put the slats on edge, because the gas must necessarily impinge against the bottom slat in going up through the scrubber. The water coming down on the top keeps the slats always moist, and the gas must come in contact with a moist surface. By this means you can, with the scrubber that you repump the water in, take about 10 grains of ammonia out of the gas. In the next scrubber we put in about 1 gallon of water to 1,000 feet of gas made. From this we make from a 5½ to a 6-ounce liquor. I would state that the strength of the liquor will make no difference with regard to the quantity of ammonia you may obtain. It only requires a little more fuel to vaporize it. It is a mistake to suppose that you must have a very strong liquor. My impression is that the weaker you have the liquor the more ammonia you will obtain, because less will pass off with the gas. That is the process by which we make it. There is no expense attached to it whatever. It flows into the scrubbers in the form of gas, and passes out in the form of a liquid, and the process is simply to pump it over, using two scrubbers. You must, however, have the scrubbers, and they must be properly constructed. We make at our works about 20 pounds to the ton of coal carbonized. The process of making salts, of course the gentlemen present understand as well as I do, but perhaps my friend would like to have a word of explanation in regard to that. The water passes into wells (we use three wells) so as to thoroughly separate the tar. We first pass all the products of the works—ammonia water, tar, and everything—into one well, and then we let the ammonia water run into an adjacent well, and from that well it runs into a regular receptacle for it, and from that it is drawn into boilers or stills. These stills are horizontal boilers, without tubes or flues—plain cylinders. A fire is built underneath, and the ammonia is voporized and passes off through the still into the vat. All the steam from this boiler passes into the vat, and there the ammonia is arrested by sulphuric acid, and the salts are formed. That is the whole process. After the salts are thoroughly crystalized the covers are taken off the vats. The process is very simple. Any intelligent man can make ammonia salts and ammonia water. The important part, however, is the scrubbers; and it is essential that they should be properly arranged and of sufficient capacity.

A Member—I would like to inquire whether the gas leaves the scrubber absolutely free from ammonia?

Mr. McIlhenny—No, sir; it leaves the scrubbers with from four to five grains. It is never free from ammonia with us. We have from two to three grains after it leaves the purifiers It averages from two and a-half to three grains.

Mr. Price—Is the two or three grains delivered to the consumer?

Mr. McIlhenny—Yes; about two and a-half grains. We are restricted by law to five grains, and we must keep within that.

Mr. Wood (of New Bedford)—The gentleman last up seems to understand the subject of making ammonia very well. I would like to give a little of my own experience, and have him tell me how I am to get in the right direction. At any rate, a comparison of our views or experiences may be of some service to the members of this Association.

I represent a small gas works where we make from 70 to 80,000 feet per day. We have but one scrubber, 10 feet high and about five feet in diameter. Last spring we commenced using ammoniacal liquor to wet our scrubber with, and we found that our liquor, as we make it from the condenser and the hydraulic main (running, as Mr. McIlhenny has stated, into one tank, then into a second, and then into a third, for use), is about 2° Twaddle, as it comes from the condenser. We pump it off into a tank, and run it into the scrubber. We find that we can clean our gas from ammonia just as well in that way as we were doing with the water from the city. We get along very well until we get it up to 4½° Twaddle, and when it gets there we cannot go any further with it. It stops operation both as regards sulphur and ammonia. We have to stop there and draw off the water and put in fresh. I want to ask if there is any way by which we can purify this liquor. I have heard gas men talk about getting the liquor up to 16° Twaddle. We cannot get that. We can get about six, but the operation is then suspended. It does not take the ammonia; it does not take the sulphur. Last week we ran clear up until it stopped its operation, and we found that we were then nearly five degrees Twaddle, and the ammonia went up to four grains. We changed, and took the other water, and it went down to ·4 of a grain, and remained so, and was so when I left, and the sulphur was about four grains. I want to know whether there is any way by which we can purify this liquor any further, or whether it is better to let it go and make new when you get to that point.

Mr. Sherman (of New Haven)—In this connection I will give my experience in regard to making ammonia. At one time I was selling our hy-

draulic main liquor at 25 cents per barrel, to parties who utilized it in manufacturing. That was when I was at Worcester. They told me to bring up the liquor to 10 ounce strength, and they would give me one dollar a barrel for it. I put up a scrubber, a description of which I found in the English *Gas-Light Journal*, which consisted of a cylinder 20 feet by 6, which was all the space I had for it. I had no difficulty in producing a ten-ounce liquor. I sent the party down a sample lot, and he informed me that he could not use it—that it was so highly charged with sulphur that it stopped his stills, and so the experiment proved a failure. But I wish to state that my short experience should not be used in any manner to discourage any other attempts to utilize this product. Another thing which must be taken into account is that the state of the market prevailing at that time was entirely different from what it is now. For instance, one of the chief elements of cost in the manufacture of sulphate of ammonia is the acid. At that time—in 1873—I paid 3 cents a pound for acid, and only got 4½ cents a pound for the product. I carried the business on for a few months, and, finding that there was no profit in it, I abandoned it. In the present state of the market, you can buy acid here for one cent a pound, and you can get about 4 cents a pound for your product. That leaves quite a handsome profit, and besides you get rid of the ammonia, which I think is very desirable. We found that our bill for lime was very materially reduced at Worcester after we adopted this process. We found that a considerable amount of the sulphur impurities were taken out in connection with this washing. We did not pump our liquor over. We used pure water, at the rate of 1 gallon to 1,000 feet, and it came out a 10-ounce liquor. I investigated the subject again during the past summer, with the idea of going into the manufacture of it again; but, owing to the very contradictory reports which came to me in regard to the price, I thought it best to close in with an offer which we have of 10 cents for our liquor.

Mr. Neal—We have several papers to be read. Enough time has, I think, been given to this subject of residuals, growing out of the reading of Major Dresser's paper. I therefore move that the thanks of this Association be tendered to Major Dresser for his interesting paper on London Gas Works. Carried.

Mr. Price—Before we pass from this subject I think there ought to be something said about the six hours charges that are spoken of in the paper. It seems to an extraordinary length of time, and I should like to know if anybody's experience justifies it. The statement struck me with surprise, because my attention has recently been called to some experiments made at our works, by our engineer, upon that very point. We have experimental works, and our engineer turned his attention to the question of how long it was desirable to run charges, and he found, by careful experiment, that the best part of the gas was made in one hour and twenty minutes, and that during the latter part of the time there was very little gas made, and that what there was was of very little value. So we discussed the question between ourselves, whether it would not be more economical to run three hours instead of four, because there would be a large saving of time and labor. But we decided not to undertake it. I think, however, it has been pretty clearly demonstrated with us that it is not only of very little use to run more than four hours, but that it would be a great waste. I was therefore greatly surprised when I heard the statement that the English companies run six hours.

Mr. Herzog—I think, in dealing with this matter, the number of pounds of coal in a charge should be taken into consideration. Coal wants a certain amount of heat to be carbonized thoroughly. Now, if you put in a small charge, there will be a larger heated surface than if you put in double the amount of coal. Of course, if you put in a heavy charge, it will require more time to carbonize it. You can regulate it by increasing the number of pounds or reducing the number of pounds. Last summer I put in some charges, but after four hours I found that they were not quite burned out. I made a slight charge; I took 25 pounds off of the charges. The result was that I got an increase of illuminating power and a larger yield of gas. I concluded that the reason of it was that, in the case of the smaller charge, there was a smaller heated surface, and the coal was more thoroughly carbonized than it was when larger charges were put in. It is probable that in England they put in heavy charges, and it is necessary to run them longer than four hours. Perhaps it may be explained in that way.

Mr. Greenough—In the English works they put in about 225 pounds of coal every six hours. The retorts at Beckton, if I remember correctly, were about 14x24. There is one explanation suggested to me by a French engineer in regard to the running of six hour charges in the English works. It is this—that the dividends of the English companies were guaranteed, and consequently the larger the amount of money that was invested in their works the better they like it. I think his explanation is worthy of attention.

Mr. Neal—The next paper is by Mr. Chambers, of Trenton, on "Facts in Regard to Water Gas," etc. Before he reads his paper, to try the sense of the meeting, I move that when we adjourn this evening we adjourn to meet in the hall in the rear of this building. I think the committee to whom the matter was left have decided to recommend that we hold our sessions there. Had we known that we should have been so much annoyed by the heat of the room and the noise in the street, I should have made a motion before adjournment this morning to meet in the hall this afternoon. Carried.

Mr. Coggeshall—I trust the Association will not overlook the importance of the matter of unaccounted for gas. The committee which was chosen two years ago have not accomplished anything, and I now move that a committee be chosen, composed of the following gentlemen: Mr. C. White, of Rochester, Mr. A. C. Wood, of Syracuse, Mr. Isaac Battin, of Albany. I name these gentlemen because they are in close proximity to one another, and they can therefore consult together, and accomplish much more than if they were scattered throughout the United States. Carried.

Mr. Breese—Would it not be well to appoint as members of that committee gentlemen who come from all parts of the United States and Canada? I would like to have the extreme south and the extreme west represented, so that we could have the diversified opinion of the whole country. We would like to know what the results are in different kinds of soil. I think that the character of the soil has a good deal to do with leakage. I would therefore move as an amendment that a committee of five be appointed instead of three.

Mr. Price—It is too late to move an amendment.

Mr. Breese—With the permission of the Association, I make that suggestion for their consideration.

Mr. Coggeshall—That experiment has been tried, and has proved a total failure. The very object of the appointment of these gentlemen was to have a committee the members of which were within easy communication with each other. I think that such a committee will accomplish far more than a committee scattered as Mr. Breese suggests.

Mr. Price—Of course it is not expected that they will confine their investigations to their own locality and their own experience, but they will endeavor to collect information from all parts of the country and abroad. The advantage of having the members of the committee within easy reach of one another must be obvious.

[To be continued.]

**Petroleum in Germany.**—A flowing well has been struck near Heide, in Holstein (Germany), as the result of an experimental boring.—The *D. A. Polytech. Ztg.* affirms that the product is in all respects equal to the American article.

## On Tidal Sewage-Outfalls.

By James N. Shoolbred, Mem. Inst. C. E.

With a feeling of disappointment the writer perceived at last year's Sanitary Conference, held under the auspices of this Society, that there was no communication whatever upon this important branch of the sewage question. For it is one that, though so far it has drawn but little attention to itself, yet it is gradually forcing itself upon our attention, and is growing in importance; and from several reasons.

The subject of tidal outfalls, in the first instance, presents itself naturally to towns and cities situate either upon the sea itself or upon rivers affected by the tide. But, in proportion as the custodians or conservators of our large rivers become each day more stringent in preventing sewage and polluting matters from being poured into those streams, so will the authorities of the towns on the banks of the upper or fresh water portions of those streams have to look for other outlets for their sewage, at least in its undiluted condition. So that a time may come (though it is still in the distance) when one or more towns or districts on the fluvial portion of a river may combine, in order to carry away their sewage down to a point where it may be permitted to be discharged into the tideway, or into the open sea. Thus some of our large rivers may come to have a sewage carrier along one, if not along both banks (as is the case in this metropolis), for a considerable distance down their course.

Again, several of the towns on the coast, such as Hasting, Brighton, Southport, and other watering places, where it was essential to keep the shore free from all suspicion of pollution, have already constructed, at considerable expense, large intercepting conduits to convey away to a distance the contents which their original outlets emptied into the tideway directly in front of the localities themselves.

The controversy going on between the Thames Conservators and the Metropolitan Board of Works as to deposits of sewage in the Thames in the neighborhood of Woolwich, is a matter of notoriety; as is also the proposal to convey the sewage of Glasgow some distance away beyond the mouth of the Clyde, where it might flow direct into the open sea.

The town of Dublin has also been crying out very warmly for some time back about the filthy condition of the Liffy, while the inhabitants of Liverpool and of Birkenhead have long complained of the fouling of the bathing places and sea side resorts in the neighborhood by slimy deposits of sewage; and their complaints are registered as far back as 1869, in the first volume of the Report of the River Pollution Commissioners.

For these and other reasons is this question of tidal outfalls for sewage gradually forcing itself, and in an unwelcome manner, upon our notice.

It is therefore not inopportune that in this place and at this meeting this branch of the sanitary question should begin to have its due consideration assigned to it, and an approximation, at least, arrived at as to the principles upon which those tidal outlets for sewage should be based. The radical error hitherto very generally made in the position of these outlets, and the cause of the costly intercepting culverts already referred to, has been due to a misconceived notion as to the action of the tide; to a confusion of ideas between the tidal impulse, which of course passes on never to return again; and the movement imparted by it to the water, and which is the result of the passage onward of this tidal impulse.

The particles of the water, successively finding themselves under the influence of this progressive force, start along in direction with it, and endeavor, but in vain, to keep pace with it. Gradually, as they lose the influence which has dragged them along with it, the force of gravity predominates with them, and they retrace their steps backward, descending the inclined plane they had previously ascended, till they reach near to their original position, again to

come under the influence of the succeeding tidal wave and be re-impelled forward once more. Hence the movement of the water under the tidal influence is one of constant oscillation; the length traversed being in the tidal rivers and shallow seas of our coasts more intensified and more marked than in the open ocean.

That the tidal impulse, or tidal wave, as it is more generally termed, and the movement of the water, its influence, are totally distinct from one another, may very readily be seen. A mere inspection of a map giving the times of high water along our coasts, or marking the cotidal lines, will show that the progress of the tidal wave, under ordinary circumstances, is at the rate of hundreds of miles per hour, while nowhere does the speed of the water, happily, exceed some six to seven or eight miles per hour.

From these remarks it will be seen that the discharged sewage, instead of being carried away nevermore to be heard of, as some had fondly hoped would be the case, becomes subjected to this oscillating action of the tidal water. Under this influence the solid portions, after a certain period, gradually are deposited in a slimy, gelatinous, disintegrated form in the quieter nooks and bays of the shore, somewhat removed from the more active part of the current. From this gradual deposition result the offensive smells, and thence the long and costly intercepting outfall conduits in the more fastidious and sensitive of our watering-places. Similar results will undoubtedly follow elsewhere, and therefore some remedy or paliative should be sought for, in order to postpone, at least, if not to prevent, similar disastrous effects.

The first, and apparently the most natural precaution to take to prevent these ill effects, lies in the selection of the position of the outlet mouth, which should, if possible, be into a part of the tideway where the direction of the current is not parallel to the line of the coast, but somewhat deflected from it, so that the sewage, in its oscillatory travels, may not be brought back upon the shores whence it issued. But this, and numerous other circumstances, require in each case a special study of each individual locality, too long to be discussed here. Enough, however, has been said to show that this question of tidal sewage outfalls is one worthy of attention, and one which is daily growing in importance.

A river into which the tide enters, and which has populous towns upon its banks, situate upon the tidal as well as upon the fresh water portion of its course, becomes, with the prevailing system of water-carried sewage, itself a large sewage outlet into the sea. The magnitude of its fresh water current and the proportions the polluting matters bear to its waters depend very largely upon the area of the water-shed upon its rainfall, together with the geological and other physical conditions, or, in other words, upon the size and formation of the river basin belonging to it.

The Congress recently held here on National Water Supply have in their resolution requested, and apparently with much judgment, the Council of the Society of Arts to memoralise the Government to collect information on the subject of the sources of supply which are available, and to adhere to the river basin as the unit of classification for such information.

It would likewise appear, in the writer's opinion, to be equally fitting that information as to that portion of the rainfall, which is polluted and rendered unfit for use by sewage and other matterr, should also be collected, as a supplemeat to such water-source information, and, like it, should be arranged under the various water-shed areas.—*Journal of the Society of Arts.*

### Ammonia Manufacture a Sanitary Agent.

—The ammonia of the commercial fertilizers manufactured in the suburbs of Augusta, Georgia, is said to have completely driven out the chills and fever and other malaria that used to infest that locality.—*Iron Age.*

### Naphtha Lamps Out.

The police reports for Monday night show that there were 207 naptha street lamps out. As showing the widespread cause for complaint in this particular the following extract from the patrolmen's reports is appended:

Eight out between 9 and 12 o'clock on Woodbridge street from Griswold to Third.

Five out before 11 P. M. on Woodward avenue between Woodbridge street and the river.

All but one out on Jefferson avenue between Shelby and First streets at 12.30 A. M.

Three out on the corner of Lafayette avenue and Wayne street at 12 o'clock.

At 10:30 all out but two on Grand River avenue, between Adams and Washington avenues.

Seven out on Woodward avenue, between Grand River avenue and Park street.

Seven out on Jefferson avenue, between First and Third street.

Fight out on Woodward avenue, between Michigan and Grand River avenues.

Eleven out on Congress and Larned streets, between Griswold and Third.—*Detroit Free Press, Sep. 23.*

**A New Method** of determining the heat value of fuel.—With regard to the important question of the heat value of fuel, it has been proved that conclusions from the results of elementary analysis are very uncertain, and, also, that little reliance can be placed on direct evaporisation experiments. In a recent paper in *Die Chemische Industrie*, Dr. Weyl points out the faults of these methods, and recommends, as preferable, decomposition of the fuel by dry distillation and analytical determination of the solid, liquid and gaseous products of decomposition. In this method the accident of too small a sample being used is avoided, and also too great pulverization and drying at high temperature and the decomposing action of atmospheric oxygen, which is therewith connected, and the whole of the coke is weighed, and its carbon, hydrogen and mineral constituents determined. The water, tar and gas that are formed are measured and their heat of combustion ascertained with the aid of data that have been supplied by Favre and Silberman and Deville. The final result will, of course, exceed the true combustion value of the coal by the amount of heat equivalent to the work of decomposition into coke, tar and gas. The decomposition of the coal should be done as quickly as possible, and at a high temperature.—*Iron.*

### Prices of Gas Coal.

| | | |
|---|---|---|
| Waverly Youghiogheny | 5.25 | |
| Moore's " | 5.50 | |
| Shafton | 5.35 | |
| Despard Marion | 5.15 | |
| Newburgh Orrel | @ | 3.85 at Baltimore. |
| Murphy Run | 5.25 | |
| Chesapeake and Ohio Agency Coal | 5.25 | 4.00 at Richmond. |
| Newcastle | 3.75 @ 3.85 | |
| Provincial | 4.15 @ 4.50 | |
| Cannelton Cannel | 10.00 | |
| Ince Hall | 8.00 | |

### Gas Stocks.

**Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks,**
**(with W B Scott & Co.,)**
24 Pine Street, New York City.
November 2, 1878

☞ All communications will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

*Gas. Co.'s of N. Y. City.*

| | Capital. | Par. | Bid. | Asked. |
|---|---|---|---|---|
| Central | 466,000 | 50 | — | 80 |
| Harlem | $1,800,000 | 50 | 35 | 43 |
| " Bonds | 170,000 | | | 103 |
| Manhattan | 4,000,000 | 50 | 145 | 150 |
| Metropolitan | 2,500,000 | 100 | 105 | 108 |
| " Scrip | $1,000,000 | .. | — | 102 |
| Mutual | 5,000,000 | 100 | 55 | 65 |
| " Bonds, gold. | 900.000 | 1000 | 95 | 101 |
| Municipal | 1,500.000 | 100 | 80 | 90 |
| " Bonds | 750,000 | | 95 | 98 |
| New York | 4,000.000 | 100 | 75 | 85 |
| Northern | 270,000 | 50 | — | 100 |
| *Gas Co.'s of Brooklyn.* | | | | |
| Brooklyn | 2,000,000 | 25 | 110 | 115 |
| Citizens | 1,200,000 | 20 | 55 | 60 |
| " Scrip | 320,000 | 1000 | 90 | 95 |
| Peoples | 1,000,000 | 10 | 15 | 20 |
| " Bonds | $ 325,000 | ... | -- | 95 |
| " Scrip | 300,000 | ... | 75 | 80 |
| Metropolitan | 1,000,000 | 100 | 55 | 60 |
| Nassau | 1,000,000 | 25 | 50 | 56 |
| " Ctfs. | 700,000 | 1000 | — | 90 |
| Williamsburgh | 1,000,000 | 50 | 80 | 90 |
| " Scrip | | ... | 90 | 95 |
| Kings Co | 200,000 | 100 | 80 | 90 |
| Union Co. E N. Y. | | 25 | — | 50 |
| Richmond Co., S. I. | 300,000 | ... | 80 | 90 |
| *Out of Town Gas Companies.* | | | | |
| Bath, Maine | 70,000 | 100 | | |
| Buffalo Mutual, N. Y | 750,000 | 100 | 65 | 70 |
| " Bonds | 200,000 | 1000 | 95 | 100 |
| Baltimore, Md. | 2,000,000 | 100 | 95 | 98 |
| " Ctfs., gold | 1,000,000 | | 95 | 101 |
| Bayonne, N. J. | | 100 | | 90 |
| Brockport, N. Y. | 25,000 | 100 | ... | 80 |
| Citizens, Newark | 918.000 | 50 | — | 95 |
| " " Bds. | 124,000 | — | 105 | 107 |
| Chicago Gas Co., Ills | | | 128 | 135 |
| Cincinnati G & C Co | | | | 190 |
| Derby of Conn. | 160,000 | 100 | 60 | 80 |
| East Boston, Mass. | | 25 | 114 | 120 |
| Elizabethtown, N. J. | 300,000 | 20 | — | 130 |
| Fort Wayne, Ind. | | 100 | ... | — |
| Hannibal, Mo. | 100,000 | 100 | 95 | 100 |
| Hartford, Conn. | 700,000 | 25 | — | 168 |
| Hempstead, L I. | 25,000 | 100 | ... | — |
| Jersey City | 386,000 | 20 | 130 | 140 |
| Jamaica, L. I. | 25,000 | 100 | ... | — |
| Jacksonville, Ill. | 120,000 | 50 | 82 | ... |
| Lewistown Maine | 400,000 | 100 | 70 | 80 |
| Lima, Ohio, | 60,000 | 100 | — | ... |
| Bonds | 30,000 | | 90 | |
| Laclede St Louis Mo. | 1,200,000 | 100 | — | 75 |
| Long Branch | | 20 | 40 | 50 |
| New Haven, Conn. | | 25 | 130 | 140 |
| Peoples, Jersey City | | ... | — | 85 |
| " " Bds. | | | | 95 |
| Peoples of Albany | 650.000 | 100 | 10 | 17 |
| " Bonds | 350,000 | 1000 | -- | - |
| Peoples of Baltimore | | 25 | 44 | 48 |
| " Bonds | | | 106 | — |
| Plainfield, N. J. | 80,000 | 100 | — | 105 |
| Perth Amboy | | 25 | — | 95 |
| Rochester, N. Y. | | 100 | 50 | 60 |
| Woonsocket, R. I. | 150,000 | 100 | 95 | ... |
| Halifax N. S. | 400,000 | 40 | 148 | 150 |
| Hamilton, Ontario | 150,000 | 40 | 117½ | |
| San Francisco Gas-Co., S. Fr'isco Cal. | | | 95 | 95½ |
| St. Louis, Missouri | 600,000 | 50 | 73 | 75 |
| Stillwater, Minn. | 50,000 | 50 | — | 26 |
| Saugerties, N. Y. | 15,000 | 100 | 95 | 100 |
| Troy, Citizens | 600,000 | 100 | — | 60 |
| Toledo, Ohio | | | 95 | 97 |
| Washington, D. C. | | 20 | — | 200 |

The Williamsburgh gas company have declared a quarterly dividend of two per cent., payable on demand, at their office.

The New York gas company have declared their semi-annual dividend of four per cent., payable Nov. 1st at their office.

The following gas stocks were sold at auction—

37 shares New York, at 78½; 70 shares Manhattan, at 149½–151; 200 shares Brooklyn, at 113–116; 10 shares Manhattan, at 148; 25 shares Metropolitan, at 105; 22 shares Mutual, at 65.

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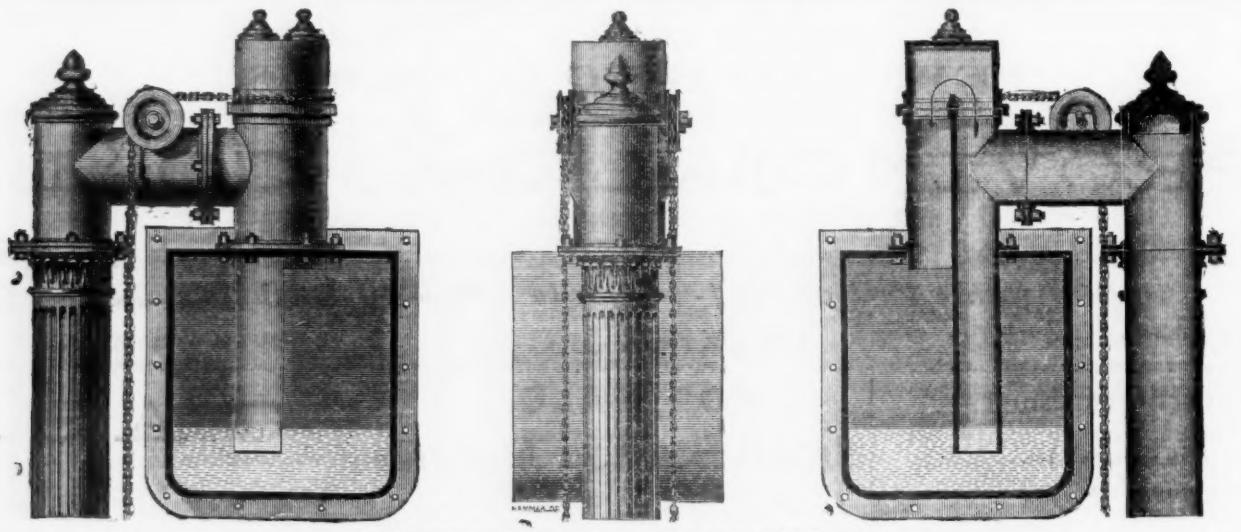

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*** Reference to them is requested. 204-x

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366-1y **Pier No. 1 (Lower Side), South Amboy, N. J.**

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# CANNELTON COAL COMPANY
**OF WEST VIRGINIA.**

Offer for sale the following Coals, from their Colliery at CANNELTON, Kanawha County West Virginia delivered at RICHMOND, Va.:

## CANNELTON CANNEL,

acknowledged to be the most valuable ENRICHER produced in this country, a gross ton yielding 10,000 cubic feet of GAS of 64·54 CANDLE POWER; COKE 32 bushels, of good quality.

## CANNELTON CAKING COAL.

*MAXIMUM YIELD*, 5.06 cubic feet of Gas per pound of Coal—A yield of 4·78 cubic feet per lb—gave 16 14-100 Candle-Power.

COKE, of very fine quality—1453 pounds produced from one ton of coal.

**J. TATNALL LEA,** Treasurer, P. O. Box 1747 Philadelphia.
SALES AGENTS - **(PERKINS & CO.,** 45 South Street, N. Y.;
**DANIEL W. JOB & CO.,** 91 State Street, Boston.
**(H. W. BENEDICT & SON,** New Haven.

---

## PARTNERSHIP NOTICE.

The partnership heretofore existing between the undersigned, under the style of *PERKINS & JOB*, is hereby discontinued by mutual consent.

Either partner is authorized to sign the name of the firm in liquidation.

NEW YORK, } Aug. 1st. 1878. JAMES D. PERKINS, }
BOSTON. } DANIEL W. JOB. }

The business of the late firm of *PERKINS & JOB*, in *NEW YORK*, will be continued by the undersigned under the style of *PERKINS & CO.*

45 South Street, } JAMES D. PERKINS, }
New York, Aug. 1st., 1878. } F. SEAVERNS, JR. }

—OO—

The business of the late firm of *PERKINS & JOB*, in *BOSTON*, will be continued by the undersigned under the style of *DANIEL W. JOB & CO.*

91 State Street, }
Boston, August 1st, 1878. } DANIEL W. JOB.

---

# CHESAPEAKE AND OHIO RAILROAD
## COAL AGENCY.

FOR THE SALE OF THE SUPERIOR

# KANAWHA GAS COALS,

ALSO,

**CANNEL,**
**SPLINT,**
**and STEAM COALS.**

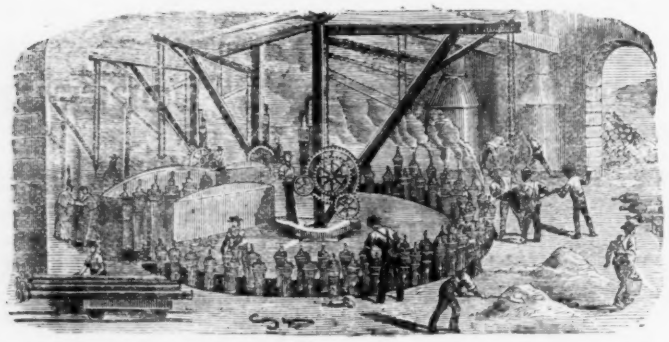
From the Kanawha and New River Regions, on the Line of the Chesapeake and Ohio Railroads.

C. B. ORCUTT, Secretary. } OFFICE No. 7 WALL ST.,
J. J. GORDON, Sales Agent. } NEW YORK.

# M'NEALS & ARCHER,

BURLINGTON. N. J,

Flange-Pipes



General Foundry Work.

## CAST IRON PIPES

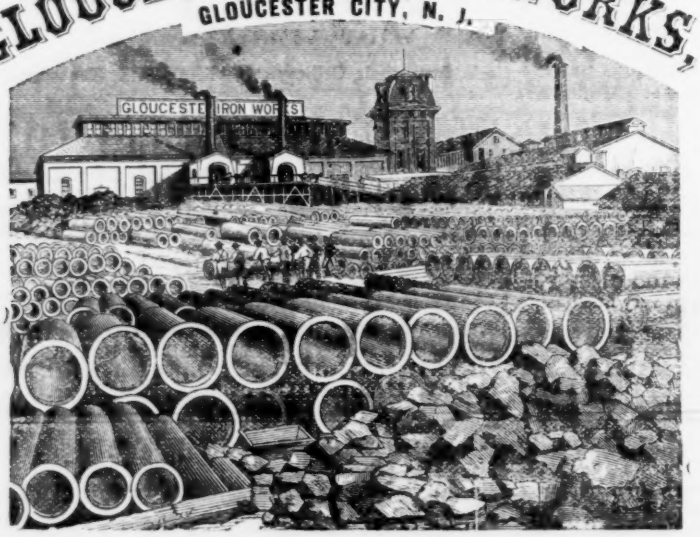
FOR WATER AND GAS.

DAVID S. BROWN, President.
BENJAMIN CHEW, Treasurer,

JAMES P. MICHELLON, Secretary,
WILLIAM SEXTON, Superintendent.

## GLOUCESTER IRON WORKS,

GLOUCESTER CITY, N. J.




## CastIron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gas Holders. &c.

Office No. 6 North Seventh Street, Philadelphia.

ESTABLISHED 1856.

## WARREN FOUNDRY AND MACHINE CO,,

WORKS AT PHILLIPSBURGH, N, J.
NEW YORK OFFICE, 153 BROADWAY.

## *Cast Iron Water and Gas Pipe*

FROM TWO TO FORTY-EIGHT INCHES DIAMETER.
ALSO ALL SIZES OF

**FLANGE PIPE for Sugar House and Mine Work.**

Branches, Bends, Retorts, Etc., Etc. 436-1

## H. R. SMITH & CO.,

COLUMBUS, OHIO,

MANUFACTURERS OF

## CAST IRON GAS & WATER PIPE,

BRANCH CASTINGS, LAMP POSTS, Etc.

(Pipe from three inch and upwards cast *vertically* in 12 feet lengths.)

**HEAVY AND LIGHT CASTINGS OF ALL KINDS.**

*DAILY CAPACITY 125 TONS.*

☞ Our Works *connect direct* with *eleven railroads* centering in this city, giving us unequalled facilities for shipping to all points, at the lowest rates freight.

## NATIONAL FOUNDRY

AND PIPE WORKS.

OFFICE AND WORKS—CARROLL, PIKE, SMALLMAN AND WILKINS STREETS,

PITTSBURGH, PA

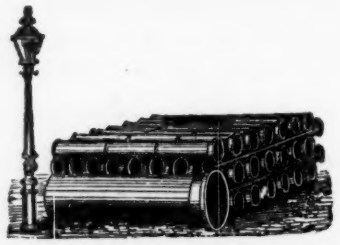
## WM. SMITH,

Manufacturer of all kinds of GAS and WATER PIPE BRANCHES, CONNECTIONS, T's, ELBOWS, and all CASTINGS USED AT GAS AND WATER WORKS,

We offer special inducements to parties wishing to purchase. My Pipe is Smooth, regular in weights, and cast vertically.

N B.—Pipe from 3 inch and upwards, cast in 12-ft. lengths.

☞ SEND FOR CIRCULAR AND PRICE LIST.



## R. D. WOOD & CO.,

PHILADELPHIA.

MANUFACTURERS OF

## CAST IRON PIPE

FOR GAS AND WATER

Lamp Posts, Valves, Etc.

Mathew's Pat. Anti-Freezing Hydrants,

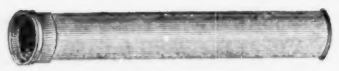
*400 Chestnut Street.*

JAMES MARSHALL & CO.

## Franklin Foundry and Pipe Works,

MANUFACTURERS OF

## GAS, WATER, AND OIL PIPES



Works, 18th, 19th, 20th and Railroad Street.
Office, No. 23 Nineteenth Street.

Pittsburgh, Pa.

N B.—Pipes from 3 inch and upwards cast in 12 ft. lengths.

☞ Send for Circular and Price List.

## BERGEN IRON WORKS.

ROBT. CAMPBELL & CO.

MANUFACTURERS OF

## CAST IRON PIPES,

FOR WATER AND GAS,

Valves, Fire and Dock Hydrants,

Lamp-Posts and Flange Work,

Bench Castings for Gas Works, &c.

Office 112 Leonard Street, N. Y.

B. S, BENSON.

MANUFACTURER OF

Cast Iron Pipes and Fittings

AND

## Gas and Water Mains.

All sizes from 3 to 30 inch cast vertically in 12½ feet lengths

Office & Factory 52 East Monument St.,

BALTIMORE, MD.

## S. DECATUR SMITH,

## CAST IRON GAS AND WATER PIPE,

Foundry, Cor. of York and Moyer Streets,

PHILADELPHIA.

Several Thousand 2, 3, 4, 6 and 8 Inch Cast Iron *Gas and Water Pipes* on hand, for immediate delivery.

FITTINGS FOR GAS WATER MAINS.

**MURRAY & BAKER,**

## Practical Builders,

**And Contractors for the Erection of Gas Works,**

MANUFACTURERS OF ALL THE LATEST AND MOST IMPROVED APPARATUS AND TOOLS FOR THE MANUFACTURE & DISTRIBUTION OF COAL GAS.

☞ WORKS AT THE RAILWAY DEPOTS,

**FORT WAYNE, INDIANA.**

We manufacture Bench Castings, Washers, "The Immersed Multitubular," and Atmospheric Condensers, Wet and Dry-Lime Purifiers, Dry Center Seals, Telescopic and Single Gas Holders, Wrought Iron Trussed Roof for Iron or Slate, Wood and Iron Trays for Purifiers, Coke and Coal Carts, Wrought Iron Screening Shovels and Castings, and Wrought Work of every description for Gas-Works.

As Mr. Murray is a Practical Draughtsman, we will furnish plans and specifications to parties or associations, or will wait personally upon parties contemplating the construction of new works, or the alteration or extension of old ones

The most satisfactory references can be given, if required of the experience and commercial fairness which characterizes our dealings.

We would respectfully invite Western men to call and see our patterns and works here. MURRAY & BAKER,
Fort Wayne, Indiana

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GEO. STACEY. HENRY RANSHAW WM. STACEY

**GEO. STACEY & CO.**

MANUFACTURERS OF SINGLE AND TELESCOPIC

## GAS-HOLDERS,

AND ALL KINDS OF

**Cast and Wrought Iron Work**

Used in the Erection of Gas and Coal Oil Works.

Foundry on MILL STREET; Nos. 33, 35, 37 and 39.
Office and Wrought Iron Works on RAMSAY STREET Cincinnati, Ohio.

REFERENCE.

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| Cincinnati Gas-Light Co. | Baton Rouge, La., Gas Co. |
| Indianapolis Gas Co. | Saginaw, Mich., Gas Co. |
| Dayton, O., Gaslight Co. | Oshkosh, Wis., Gas Co. |
| Covington, Ky., Gas Co. | Peoria, Ill., Gas Co. |
| Springfield, O., Gas Co. | Quincy, Ill., Gas Co. |
| Terre Haute, Ind., Gas Co. | Champaign, Ills., Gas Co. |
| Madison, Ind., Gas Co. | Carlinville, Ill., Gas Co. |
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## BROWN & OWEN,

MANUFACTURERS OF

EVERY DESCRIPTION OF

## Gas and Water Works Supplies.

Particular attention given to the alterations of old works

Estimates and Drawings furnished.

Address all communications to

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420–1y **PHILADELPHIA.**

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**HERRING & FLOYD,**

## Oregon Iron Foundry

738, 740, 742 and 744 Greenwich St,, N. Y

MANUFACTURERS OF

**ALL KINDS OF CASTINGS**

AND

**APPARATUS FOR GAS-WORKS.**

**BENCH CASTINGS**
from benches of one to six Retorts each.

**WASHERS: MULTITUBLAR AND AIR CONDENSERS: CONDENSERS; SCRUBBERS,**

wet and dry), and

**EXHAUSTERS**
for relieving Retorts from pressure.

**BENDS and BRANCHES**
of all sizes and description.

FLOYD'S PATENT
**MALLEABLE RETORT LID.**

SABBATON'S PATENT
**FURNACE DOOR AND FRAME.**

SELLER'S CEMENT
for stopping leaks in Retorts.

GAS GOVERNORS,

and everything connected with well regulated Gas Works, at low price, and in complete order.

N. B.—**STOP VALVES** from three to thirty inches—very low prices.

SILAS C. HERRING. JAMES R. FLOYD.

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**1842. DEILY & FOWLER 1878.**

## *LAUREL IRON WORKS.*

ADDRESS, 39 LAUREL STREET,

**PHILADELPHIA.**

MANUFACTURERS OF

## GAS HOLDERS,

*SINGLE AND TELESCOPIC—WITH CAST OR WROUGHT IRON GUIDE FRAMES.*

We are prepared to furnish Holders, Wrought Iron Roof Frames, Bench Castings, Condensers, Scrubbers, Purifiers, Drips, Bends, Tees, and all other Iron Work connected with Gas Works. Previous to 1868 our Mr. D. built *nine Gas Works* and *fifty-four Holders*. Since that date we have built *three Gas Works* and *forty-six Holders*. We *superintend in person* the erection of all our work, and would refer to the Gas Companies at the following places, where we have built Holders since 1868:

| | |
|---|---|
| Lancaster, Pa. | Barnesville, O. |
| Williamsport, Pa. | Franklin, Ind |
| Bristol, Pa. | Jacksonville, Ill. (2) |
| Catasaqua, Pa. | Joliet, Ill. |
| Kittanning, Pa. | Lawrence, Kansas. |
| Hazelton, Pa., | Jefferson City, N. O., La |
| Freeport. Pa. | Algiers, N. O., La. |
| Huntingdon, Pa. | Kalamazoo, Mich |
| Pittston, Pa. | Buffalo, N. Y. |
| Bethlehem S). Pa. | Ogdensburg, N. Y. |
| Sharon, Pa. | Waverly, N. Y. |
| Canton, Pa. | Little Falls, N. Y. |
| Annapolis, Md. | Penn Yann, N. Y |
| Parkersburg, Wes, | Watkins, N. Y. |
| Lynchburg, Va. | Gloucester, N. J. |
| Youngstown, O | Salem, N. J. |
| Steubenville, O. | Mount Holly, N. J. |
| Zanesville, O. | Plainfield, N. J. |
| Mansfield, O. | Englewood, N. J. |
| Marion, O. | Dover, Del. |
| Bellevaire, O. | Pittsfield, Mass. |
| Athens, O. | Meriden Conn- |

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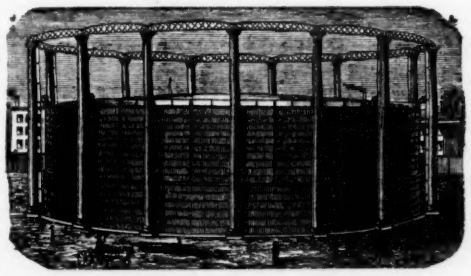
# CONTINENTAL WORKS.



GASHOLDERS OF ANY MAGNITUDE.

**T. F. ROWLAND, Proprietor,**

**GREENPOINT, BROOKLYN, N. Y.**

ENGINEER AND MANUFACTURER OF

## GAS-HOLDERS,

**CONDENSERS, SCRUBBERS, VALVES, PURIFIERS, RETORTS, and HYDRAULIC MAINS,**

and all other articles connected with the Manufacture and Distribution of Gas. Plans and Specifications prepared, and Proposals given for the necessary Plans for Lighting Cities. Towns, Mansions, and Manufactories.

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## NATIONAL COAL GAS COMPANY.

**320 Broadway, N. Y., Rooms 50, 51 & 52.**

**Elevator on Pearl Street.**

**H. P. ALLEN, President.**

The process known as GWYNNE-HARRIS, but from later most essential improvements, more appropriately called the ALLEN-HARRIS, or AMERICAN HYDROCARBON process for making "Water Gas," by the decomposition of superheated steam, in fire-clay retorts, set similarly to those in Coal Gas Works, is an established success. More than One Hundred Million cubic feet of gas have been made under this process, and for *permanency* and *brilliancy*, as well as economy both to the manufacturer and consumer, it is superior to any gas made by the old, or any other method.

Our process is *not intermittent* but continuous. The steam and the oil are admitted into the retorts by gauge cocks, and run for days without change. All the materials required, besides the steam, are 17 lbs. of Anthracite coal and about 3½ gallons of Petroleum or Naphtha, per 1000 feet of brilliant gas.

Rights for sale. Inquire of the President.

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JESSE W STARR & SON,

## Camden Iron Works

**Camden, New Jersey,**

**Office in Philadelphia No. 435 Chestnut St., where a member of the Firm can be seen between 12 m. and 2 p. m. daily.**

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS WORKS,

## Wrought Iron Roof Frames,

For Retort and other houses. Retorts and all castings required for setting them in the latest and most improved model. WASHERS, CONDENSERS, SCRUBBERS and EXHAUSTERS for relieving the Retorts from pressure. PURIFIERS, varying from 2,000 to 2,000,000 cubic feet daily purifying capacity.

## Wrought Iron Lime Sieves

for Purifiers. Station Meters of all sizes.

## GAS HOLDERS.

TELESCOPIC AND SINGLE

With cast iron guide and suspension frame GAS GOVERNORS or REGULATORS, STREET MAINS, from 1½ 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SLEEVES, etc.

STOP VALVES, from 3 to 30 inches, for both Water and Gas.

## Wrought Iron Work.

All the Smith and Sheet Iron work required in and about Gas Works. 296-tf

JESSE W. STARR. JESSE W. STARR, Jr.

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# MACKENZIE & SAYRE MAN'F'G CO.,

**141 BROADWAY, NEW YORK.**

## Gas Works, Smelting Works & Machinery.

Proprietors of P. W. MACKENZIES PROCESS AND APPARATUS for making Illuminating Gas from Ordinary Gas Coals, enriched with Cannel or Oil. Also, Mackenzies Process for Making Heating Gas for Smelting, Melting, Puddling, Forges, Boilers, Etc. Also,

## P. W. Mackenzie's New Engine and Boiler,

434—1y

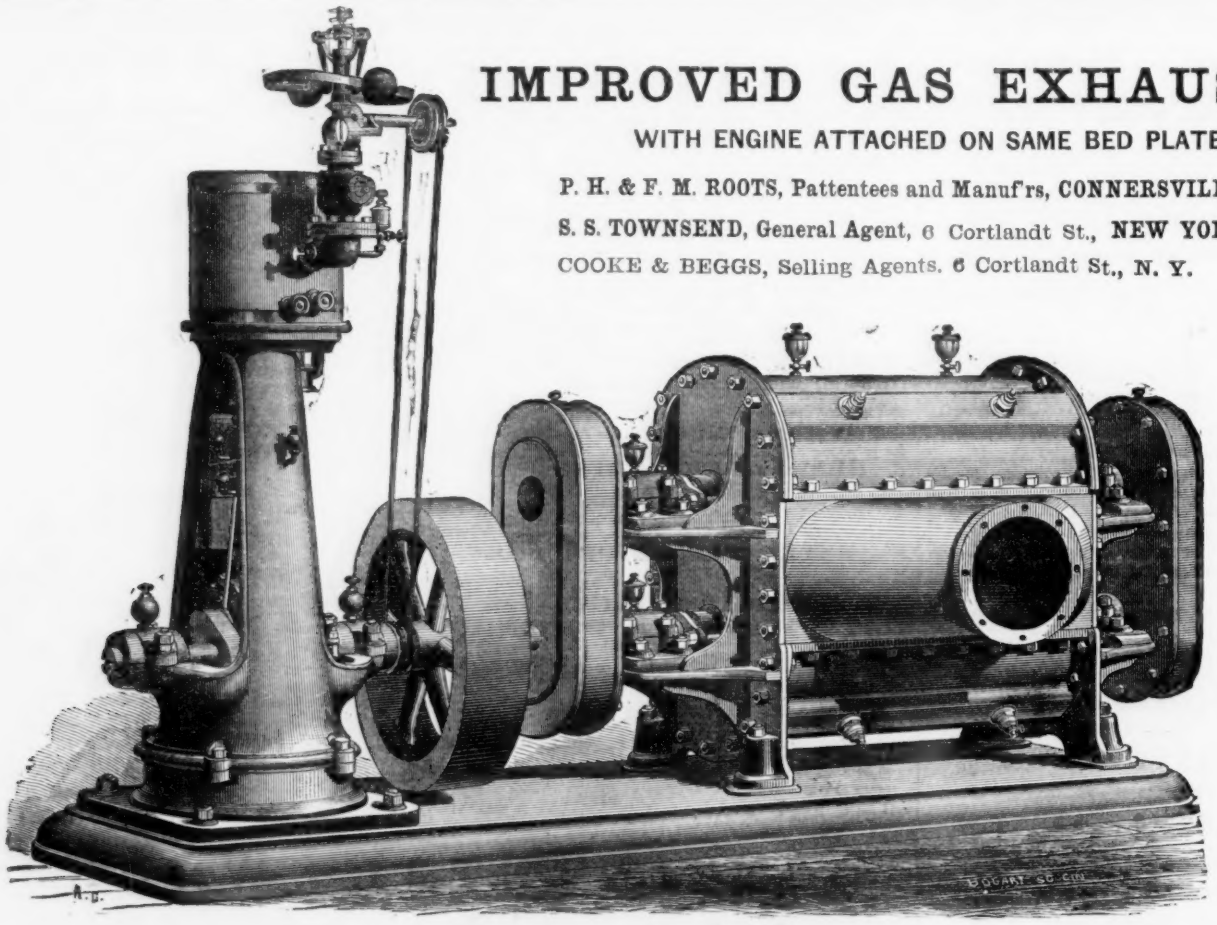
# IMPROVED GAS EXHAUSTER,

WITH ENGINE ATTACHED ON SAME BED PLATE.

P. H. & F. M. ROOTS, Pattentees and Manufrs, CONNERSVILLE, IND.

S. S. TOWNSEND, General Agent, 6 Cortlandt St., NEW YORK.

COOKE & BEGGS, Selling Agents. 6 Cortlandt St., N. Y.



ADVANTAGES CLAIMED FOR THIS EXHAUSTER.

1. It is simpler than any other Exhauster. The internal operating parts consist of only two pieces, cast entire, and can not get out of order.
2. Every part requiring care or attention, is external and easily accessible. All changes, adjustments, and repairs are made from the outside.
3. The revolvers, though practically gas-tight, do not run in actual contact, hence there is no friction, and a great saving of power effected.
4. They are built in the most complete and substantial manner, and of any required size, with steel shafts and improved journal bearings.
5. We furnish Exhausters and Engines combined on same Bed Plate, as shown above, or the Exhauster only, as may be required.
6. We also furnish Bye Passes and Gas Valves on improved plans, also Exhauster Governors and Elbows, Pipes, Drawings, etc.

Send for Illustrated Catalogue, giving details of capacity, speed, power required, price, and references to parties using them.

P. H. & F. M. ROOTS.

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## J. H. GAUTIER & CO.,

CORNER OF

GREENE AND ESSEX STREETS,

*JERSEY CITY, N. J.*

MANUFACTURERS OF

**Clay Gas Retorts,**

**Gas House Tiles,**

**Fire Bricks, Etc. Etc.**

**Ground Clay, Fire Brick and Fire Sand in Barrels,**

*ALWAYS ON HAND.*

J. H. GAUTIER.
C. E. GREGORY

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## Brooklyn Clay Retort AND FIRE-BRICK WORKS.

Manufacturers of Clay Retorts, Fire Bricks, Gas House and other Tile, Cupola Brick, etc. Dealers in and Miners of Fire Clay and Fire Sand. Clay bank at Burt's Creek, New Jersey. Manufactory: Van Dyke, Elizabeth, Richards and Partition Streets, Brooklyn, N. Y. Office, No. 88 Van Dyke Street.

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## LACLEDE FIRE BRICKS AND GAS RETORT WORKS

CHELTENHAM, MO.

Hand and Machine made Retorts and Settings, Superior Fire Bricks for Siemans Gas and Glass Furnace. Bricks and Tiles for Whitwell's Hot Blast Ovens, Blast Furnace and Cupola Tiles, Etc.

*Fire Bricks and Tiles*

of all shapes and sizes.

Glass Pot Clay. Fine Ground Clay and Fire Bricks. Sewer Pipe, Etc.

**901 Pine Street, St. Louis, Mo.**

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## MANHATTAN FIRE BRICK & ENAMELLED CLAY RETORT WORKS.

ADAM WEBER,

(Successor to MAURER & WEBER.)

PROPRIETOR.

**Office and Works, 15th Street, Avenue C.**

Manufactures of

**FIRE BRICK AND TILES,**

Of all shapes and sizes.

FIRE MORTAR, CLAY AND SAND.

☞ Articles of every description made to order at short notice. 1)5t.

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Works: LOCKPORT, PA.

*Established 1864.*

Works: MT. SAVAGE JUNCTION. MD

## GARDNER BROTHERS,

**Manufacturers of Clay Gas Retorts and Retort Settings,**

**"STANDARD SAVAGE"**

**Fire Brick, Tile and Furnace Blocks,**

AND

MINERS AND SHIPPERS OF FIRE CLAY.

Sole Agent for New England
C. H. SPRAGUE,
86 State Street, Boston.

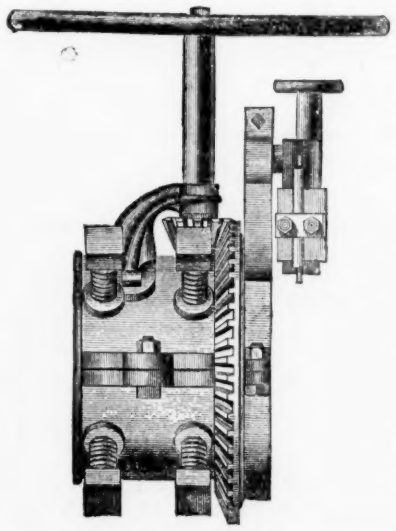
OFFICE: No. 376 PENN AV'E., PITTSBURGH, PA.

# A. C. WOOD'S
# CAST IRON PIPE CUTTER

PATENTED MAY 23rd, 1876.

*PRICES REDUCED TO MEET THE TIMES.*

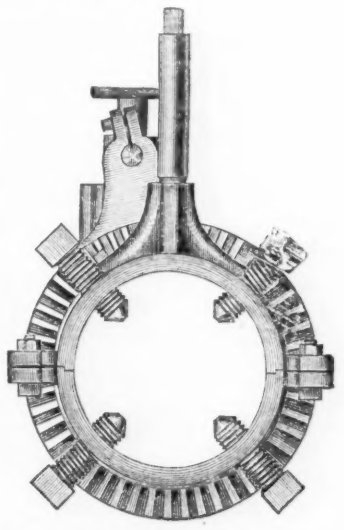
We have been able to reduce the cost of Manufacturing, and desire to give our Customers the benefit at the following



**REDUCED RATES:**

*No. 1 cuts 3, 4 and 6 inch Pipe* $75
*No. 1 1-2 cuts 4, 6 and 8 in. Pipe,* $85
*No. 2 cuts 8, 10 and 12 in. Pipe,* $100
*No. 3 cuts 16, 18 and 20 in. Pipe,* $225
*NO. 4 cuts 24 and 30 inch Pipe,* $275
*No. 5 cuts 36 inch Pipe,* $350

*For larger sizes Special Contracts will be made.*



**It will cut a Continuous Line of Pipe in a Trench or Building**

As well as loose Cast or Wrought Iron Pipe, Shafts or Columns of any size, leaving the ends clean, smooth, and square.

Our Machines for cutting 20 and 30-INCH PIPE have been furnished the Manhattan and New York Gas Light Companies; also for cutting 12, 20, and 30 inch Pipe to the Boston Gas-Light Company. The smaller sized Machines have been in practical use in various parts of the country by Water and Gas Companies, for over two years, and all with the most satisfactory results. Address

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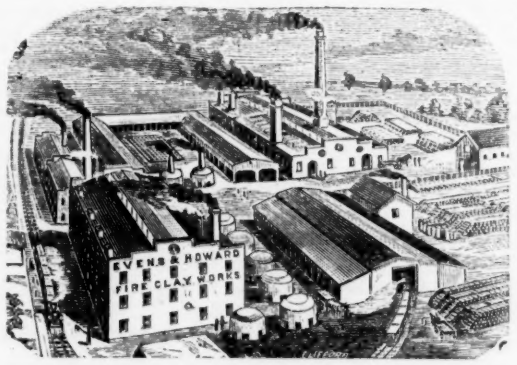
HERRING & FLOYD, No. 744 Greenwich street, N. Y.
BROWN & OWEN, 20th and Filbert Sts., Philadelphia.
MORRIS, TASKER & CO., 36 Oliver Street, Boston, Mass.

## EVENS & HOWARD,




**GAS RETORTS,**
**FIRE BRICK,**
*Retort Fittings,*
FURNACE & CUPOLA LININGS
OF EVERY DESCRIPTION.
Sewer Pipe and Drain Tile.
FINEST QUALITY GLASS HOUSE POT CLAY A SPECIALTY.
916 Market Street, ST. LOUIS.

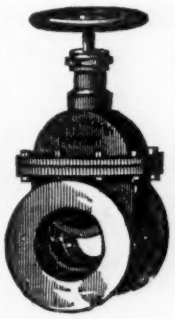
THROUGH CARS LOADED AT FACTORY FOR ALL ACCESSIBLE POINTS.

## LUDLOW
## Valve Manf'g Co.,

OFFICE AND WORKS
938 to 954 River Street and 67 to 83 Vail Ave.
TROY, NEW YORK.

**BRASS AND IRON SLIDE VALVES.**

(Double and Single Gate ¼ inch to 36 inch—outside and inside screws, Indicator etc.) for Gas, Water and Steam—
HYDRAULIC MAIN DIP REGULATORS.
ALSO
**FIRE HYDRANTS.**



REFERENCES FURNISHED.
SEND FOR CIRCULARS.

*Established in 1845.*

## B. KREISCHER & SONS,

Office Foot of Houston Street, E. R., N. Y.

## GAS RETORTS, TILES and FIRE BRICK

*Of all Shapes and Sizes.*

**FIRE MORTAR, CLAY and SAND**

ARTICLES OF EVERY DESCRIPTION MADE TO ORDER AT THE SHORTEST NOTICE.

## BORGNER & O'BRIEN,

MANUFACTURERS OF

**Clay Gas Retorts and Retort Settings, Fire Bricks, Tiles, Etc.**

TWENTY-THIRD STREET BELOW VINE—PHILADELPHIA.

15 Years Practical Experience. GAS HOUSE WORKS a Specialty 448

## INTERNATIONAL--1876--EXHIBITION.

## The U. S. Centennial Commission

HAVE DECREED AN AWARD TO

## *HARRIS, GRIFFIN & CO.,*

**12th and Brown Sts., Philadelphia, and 49 Dey St., N. Y., U. S. A.,**

FOR THE FOLLOWING REASONS:

The Exhibit consists of a Series of METERS from the Largest Size Station Meters for the use of the MANUFACTURE OF GAS, to those for the use of the ORDINARY CONSUMER. The Instruments are WELL MADE, RELIABLE as to INDICATION, and embody a number of sundry improvements which, with the general character of the Exhibit, entitle the whole to commendation.

Attest—J. L. CAMPBELL, Secretary, pro-tem. Signed—A. T. GOSHORN, Director General J. R. HAWLEY, President

GROUP JUDGES.

*AMERICAN.*

PROF. JOSEPH HENRY, LL.D., Secretary of Smithsonian Institution, Washington, D. C.
PROF. F. A. P. BARNARD, S.T.D., LL.D., President of Columbia College, N. Y.
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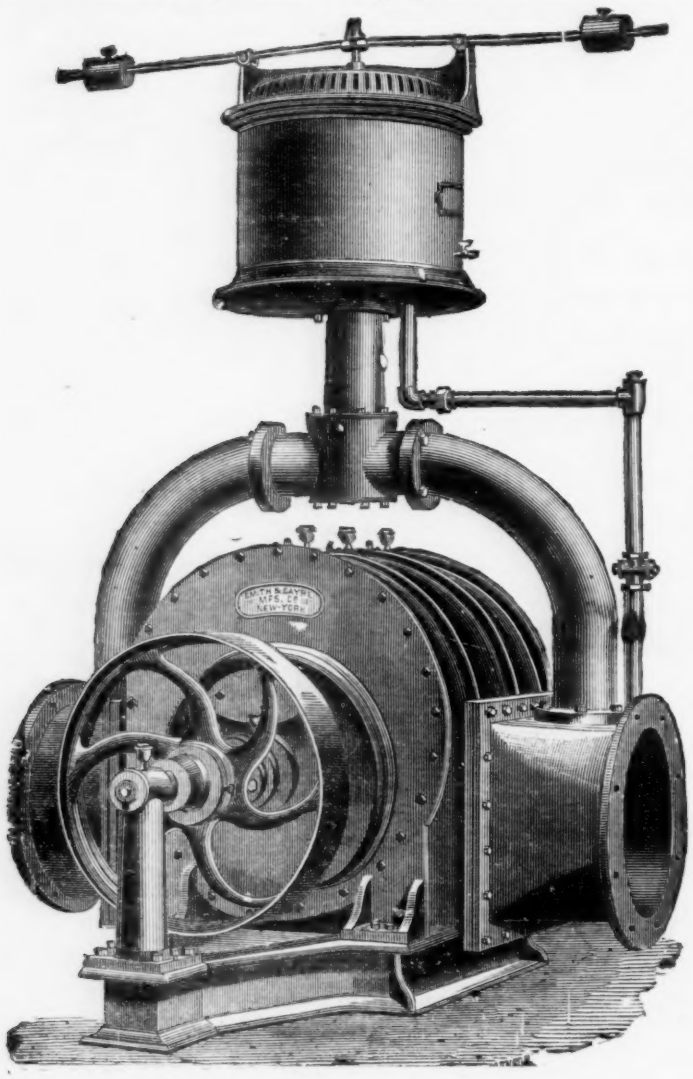


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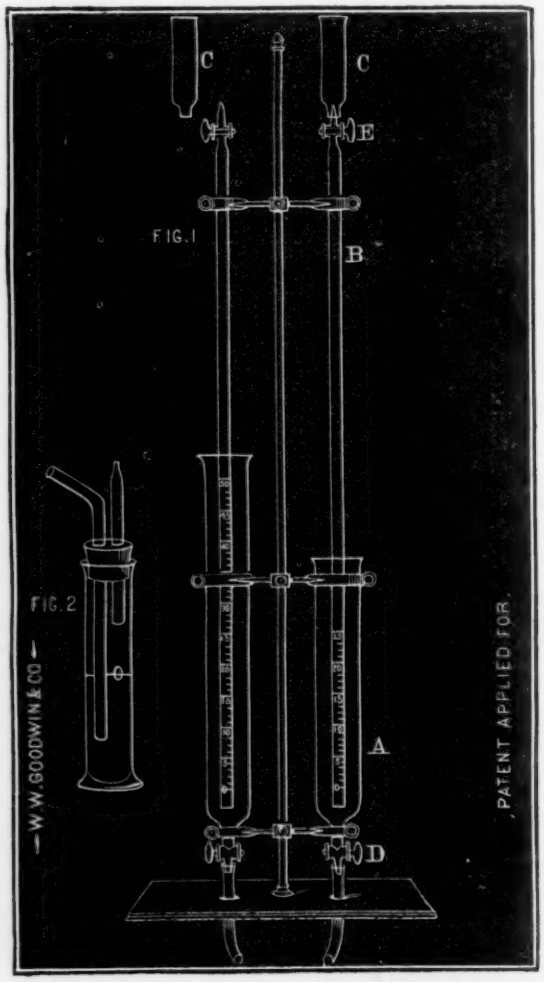


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